ELECTRONICS Australia

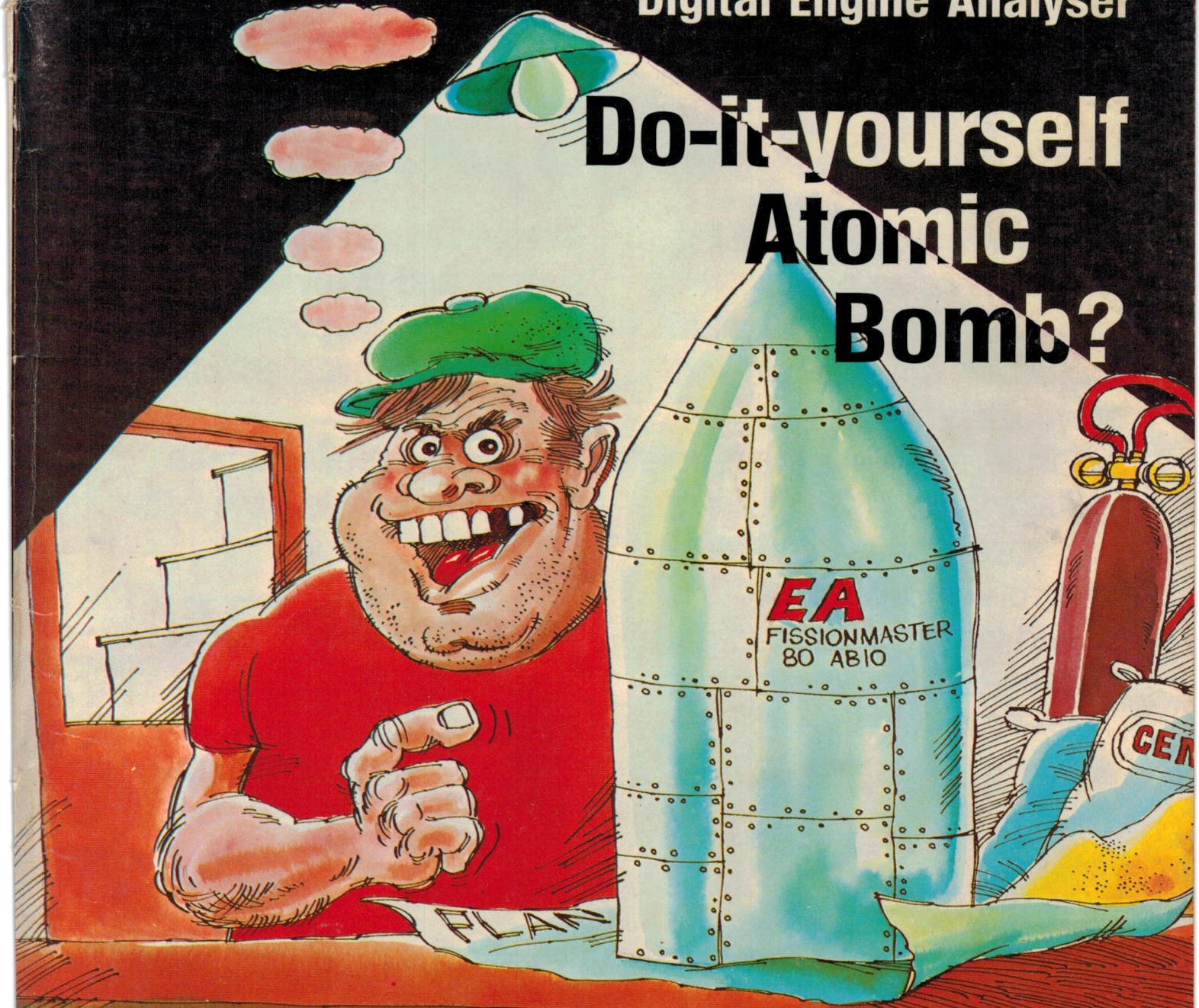
HiFi, Video & Computers

OCTOBER, 1980

AUST $1.60* NZ $1.70

Digital Engine Analyser

Do-it-yourself Atomic Bomb?



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- Battery Monitor

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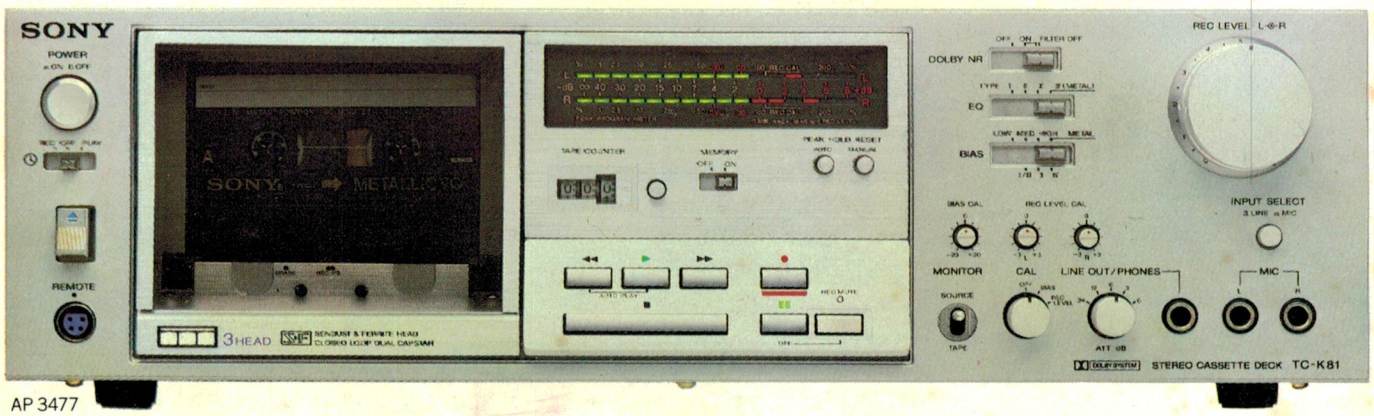

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ELECTRONICS Australia

Volume 42 No. 7 October, 1980

Australia's largest selling electronics magazine

Tacho/dwell meter for tune-ups

Tune-up with our new Digital Engine Analyser. It's easy to build and measures RPM, dwell and battery voltage on any four, six or eight-cylinder petrol engine. Details p40.

How many hours of service has your hifi stylus given? This new digital stylus timer solves the problem by recording stylus use up to 999 hours. See p54.

COMING NEXT MONTH – Find out what's coming by turning to p108.

On the cover

Construction of an atomic bomb is simple – in theory. Our feature article on p12 tells how to construct a device that should satisfy even the most fanatical terrorist. (Cover design by Garry Lightfoot).

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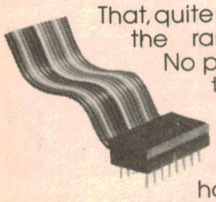

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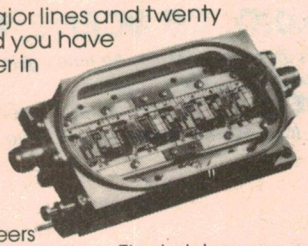

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- Piezo Technology • Tecknit • Transco Products • Elu Elektro - Union GMBH • Compas Microsystems • OPCOA

Components Listing
- Microprocessors, Integrated Circuits
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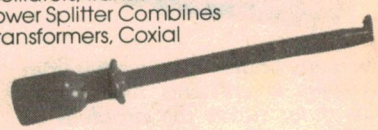

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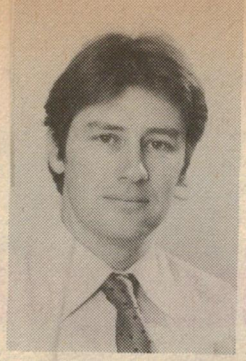

Editorial Viewpoint

Australia and Nuclear Technology

Some readers may be offended, this month, by our publication of the article entitled "Do-it-yourself Atomic Bomb?". We certainly did not set out to offend such readers. We re-printed the article, which has already been published in at least two overseas journals, because it is informative and because we think it is also entertaining. Its tongue-in-cheek presentation highlights the very high level of technology and infrastructure required for the manufacture of an atomic bomb. At the very least, it should help put to rest the fears of some people that they may, one day, be held at ransom by group cellar workshops of terrorists who have manufactured their very own A-bomb.

While it seems likely that terrorists will continue to exert pressure in various parts of the world, their means of imposing terror are likely to be more prosaic than home-made nuclear weapons.

Less obvious is the fact that, even though a country may have a substantial investment in nuclear power stations, this does not give it automatic access to the technology of nuclear weapons or, more importantly, to a stockpile of weapons-grade uranium. By way of explanation, weapons-grade uranium is enriched to 97% uranium-235 while uranium destined for power stations is enriched to a mere 3%. In other words, there is not necessarily a connection between nuclear power and nuclear weapons, although you would not think so to judge from some of the hysterical "debate" going on in Australia at the present time.

Do not jump to the conclusion that I am leading up to a plea for Australia to invest in nuclear power stations – far from it. But clearly, if Australia is to be involved in the resources of nuclear energy, it should strengthen its research into nuclear technology generally. And there is far more to nuclear technology than just power stations or, for that matter, atomic bombs.

For example, part of nuclear technology is involved with the minimisation of damage to the environment by uranium mining. Australia should be in the forefront of research in this field.

Other facets of nuclear technology are the use of irradiation in food preservation and water desalination by reverse osmosis. Australia has an important stake in developing this technology and the Australian Atomic Energy Commission is, in fact, doing research in these and many other areas.

But, as demonstrated on a recent visit by Assistant Editor Greg Swain and myself, the funding for the Australian Atomic Energy Commission is barely enough to maintain a "holding operation" at the Lucas Heights research establishment. Much of their equipment is outmoded and in need of replacement.

With Australia presumably poised to earn a great deal of income from uranium, much more should be spent on researching the associated technology, rather than having to rely on what others tell us.

Leo Simpson

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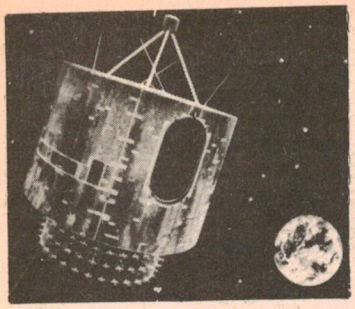


News Highlights

Rapid growth forecast for electric vehicles

The infant US electric car market – currently chugging along at less than 2000 cars per year – will reach 100,000 by 1990 and an astonishing 900,000 by 1995, says Predicasts, Inc, a US based business information and market research firm.

Batteries and Electric Vehicles, a study of the industry recently made public by the research group, indicates that the major market will be 2-3 car families who use their extra car for short-range driving. Predicasts's analysts calculate that if the vehicles now owned as second or third cars – 35 million in 1979 – were converted to electric power, US oil consumption would drop by more than five per cent.

Although the study notes that at present "only a fringe element of curious individuals have been willing to purchase an electric car," demand will gather momentum towards the end of this decade. Predicasts' researchers attribute this growth to several factors: energy availability and cost, which will begin to spur demand in the mid-1980s, and the Electric and Hybrid Vehicle Demonstration Act of 1976. The Act authorizes $160 million to be spent over a five-year period, providing financial incentives and substantially reducing the risk to participating firms. Predicasts expects this research and development to result in battery upgrading that will reduce both initial and maintenance costs while improving reliability, range and charging characteristics.

Although production of electric vehicles will skyrocket, the majority of this growth will not occur until the following decade. Because of the shift from existing technologies (ie the internal combustion engine) and the poor financial position of most US car manufacturers, American producers will fail to meet demand in the late 1980s. Predicasts expects imports to capture 60% of the electric vehicle market during this period. However, domestic capacity will increase dramatically in the early 1990s permitting US manufacturers to rebound to a 70% market share.

Although lead-acid batteries are currently used in virtually all electric vehicles, they will account for only 10% of the 1995 electric car market because of energy density shortcomings. "Exotic" advanced secondary battery systems such as nickel-zinc, nickel-iron, and lithium metal-sulfide – now commercially unavailable – "will be the major new participants" says Predicasts.

Dick Smith sells 60% interest to Woolworths

Dick Smith headquarters, North Ryde

Dick Smith Electronics Pty Ltd has sold a 60% interest in the company to Woolworths Ltd for an undisclosed sum. Woolworths directors said after announcement of the purchase that they viewed the investment as an opportunity to share with Dick Smith "in a partnership arrangement for the development of a business which has been most successful and which has a high future potential".

The Dick Smith group, with a turnover of $17.2 million and net profits of more than $2 million in 1979-80, is considered to be the leading retailer of electronic goods and components in Australia. The group operates 18 stores throughout Australia in all States except Tasmania and the Northern Territory, and a further three stores are expected to open this year.

The purchase of a controlling interest by Woolworths will provide substantial capital for the group and its founder, and a valuable injection of retailing experience. The Dick Smith group will operate independently of Woolworths Ltd, and Dick Smith and his current management team will continue to direct operations.

The General Manager of DSE, Mr Ike Bain, said that the exact areas of cooperation between the partners had not been discussed in any detail, but he agreed that a Dick Smith franchising scheme in some of Woolworths supermarkets and Big W stores was a possibility.

One of the major considerations affecting the deal was Dick Smith's desire to see that the company remained fully Australian owned. Last year the group rejected an offer by a major United States company for this reason.

Dick Smith Electronics began operation with one store in Gore Hill in 1973, and has since grown to be one of the most successful and widely known electronics businesses in Australia. The sale of a 60% share to Woolworths marks a new phase in the group's operations, and future developments in the partnership should be interesting.

Intel plans new computers

A recent article in the US magazine Business Week throws an interesting light on the plans of the big semiconductor manufacturer Intel Corporation.

During the past 10 years Intel has made two dramatic break-throughs in microelectronics – first with semiconductor memory chips and then with the microprocessor. The Santa Clara (California) manufacturer increased sales from $4 million in 1970 to $663 million last year, and is now the fourth biggest integrated circuit manufacturer in the world, responsible for over 40% of all sales of 8–bit microprocessors.

Now the company is developing new concepts to reinforce their strong market position. Earlier this year Intel outlined plans to produce devices which would enable the company to put an entire minicomputer or even a large mainframe within just a few chips. Intel is also planning to produce and market most of the software required for the new products. Previously semiconductor manufacturers have left almost all software development to their customers.

The new chips that Intel plans will be far more complex than any existing designs. Each integrated circuit of the new family will contain the equivalent of 100,000 transistors. "Just to define one of the processors we're talking about takes 10 man-years of engineering time," says Gordon E. Moore, Chairman and Chief Executive Officer of the company.

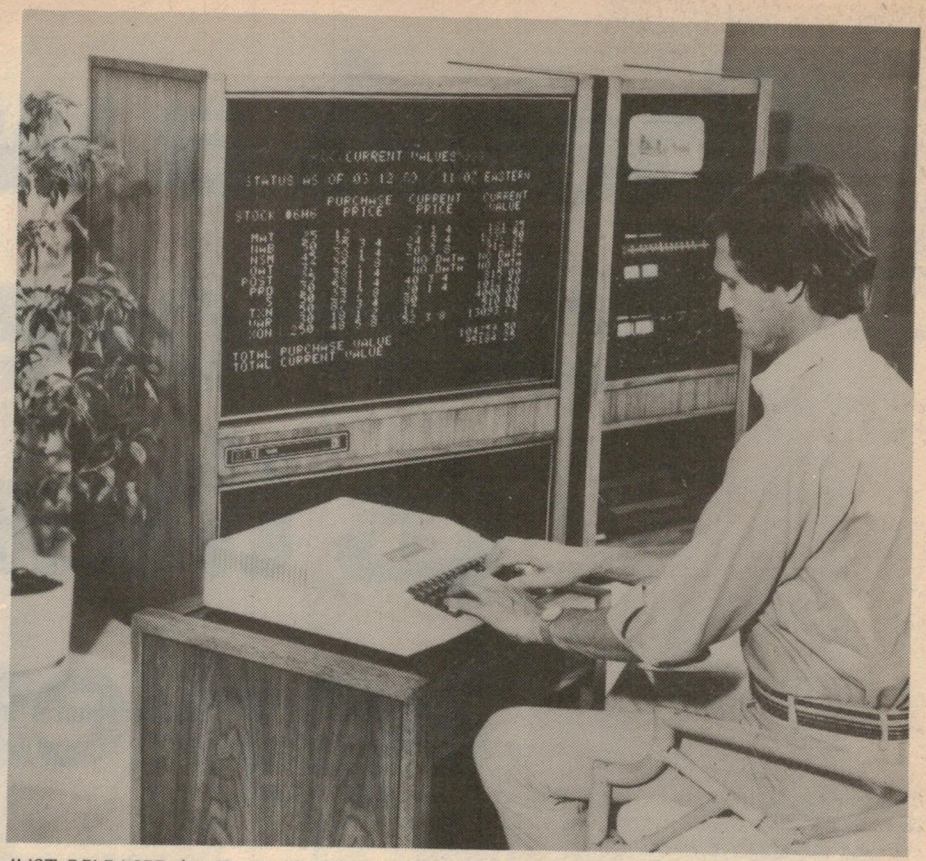
By producing its own standard software such as operating systems and a high level language compiler, Intel hopes to reduce the programming costs that customers must pay before they can use microprocessors.

Another $50m for INMOS

The British Government has given approval for a further investment of $50 million in INMOS, a company set up by the National Enterprises Board (NEB) to develop and manufacture advanced integrated circuits. The total invested in the company by the government is now $100 million.

The additional finance will allow the company to establish a production plant in South Wales specialising in the production of high capacity memory chips, and scheduled to begin operations in 1982. Another production plant is planned for the mid-1980s.

The South Wales factory will employ some 2000 people and meet part of the growing need for integrated circuits used in industrial and scientific equipment while alleviating the supply problems which are inherent in reliance on imported devices.



JUST RELEASED by General Electric, the Widescreen 3000 Home Television Centre features a big rear-projection 115cm diagonal flat screen and comes with full remote control facilities. Pictures are projected via a 3-lens system from three 12cm CRTs at the rear. GE says that the new receiver makes an ideal display device for home computer systems. Price in the US is around $3,500!

Computer updates weather reports

Telex reports of weather conditions received at London's Heathrow airport will be automatically converted into speech for radio transmission using a system called Automatic Volmet, developed by Marconi Space and Defence Systems.

Aircrew have frequently reported difficulty in understanding weather reports en route and at terminals throughout the world because of the strong accents of many operators. The new equipment is intended to provide an easily understood "standard" voice for all weather reports.

The voice of a Marconi manager reading standard weather report phrases, words and figures has been digitised and stored in a computer memory. Incoming telexes from meteorological stations around the world are converted into a code which is recognised by the speech storage system, enabling the output of the appropriate words and phrases. The system uses two PDP 11/34 minicomputers in a dual redundant configuration. A multiplexer selects which of the two processors provides the output, while the other runs in a standby mode. If one processor fails the other can take over immediately.

Sydney seminar on industrial robots

A seminar on industrial robots, entitled "Intelligent Machines at Work" will be held in Sydney on October 29. Many observers believe that Australian industry, with its short production runs and wide variety of manufactured products, is ideally suited for the application of robots. The seminar will give delegates the opportunity of gaining an understanding of the field through specialist speakers, films and other audio-visual aids.

"Intelligent Machines at Work" is sponsored by the Productivity Promotion Council of Australia, and the Institute of Industrial Engineers. Enquiries and applications for registration should be made to Gordon Seeto, the seminar co-ordinator, PPCA, PO Box J157, Brickfield Hill, NSW 2000. The registration fee prior to October 24 is $95, and after October 24 the fee is $110.

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NEWS HIGHLIGHTS

Business Briefs:

● The Department of Transport has ordered new radar equipment costing $4.74 million for the air traffic control services of Melbourne and Adelaide. The French electronics company Thompson — CSF was awarded the contract after world-wide tenders were called. Tenders will later be called for similar equipment for Perth, Brisbane, Sydney and Canberra airports.

● IBM Australia Pty Ltd has become a member of the Australian Telecommunications Development Association. Chairman of the Association Mr Allen Deegan said he believed that IBM would make a valuable contribution to the ATDA aims of strengthening the telecommunications and electronics manufacturing industries in Australia.

● Philips Telecommunications Manufacturing Company has won a contract to supply a further export order of 30 single channel remote subscriber radio-telephone systems to the Sultanate of Brunei. The order follows previous orders for Philips FM880 series equipment placed by the Brunei Department of Posts and Telecommunications in a bid to extend the country's telephone services into inaccessible regions.

● The 42nd annual National Audio-Visual Convention and Exhibit (NAVA '81) will be held in the Dallas Convention Centre, Dallas, Texas from January 14 to January 19th 1981. The Commercial Section of the United States Consulate General, Sydney, is offering assistance to any Australian business representative who plans to attend the show.

● A group of Melbourne investors has acquired the physical assets, technology and most of the staff of the former BWD Electronics Pty Ltd, which was placed in receivership in June. A totally new company has been formed, known as BWD Instruments Pty Ltd.

● After 20 years in the R. H. Cunningham organisation Joan Henman, who has been in charge of office management, has retired. Her position has been taken by Margery Kennedy. R. H. Cunningham Pty Ltd also announced the appointment of Mr Ron Azzopardi to take charge of sales of Sennheiser microphones and headphones, VSC tape recorders, and other audio products.

● Tecnico Electronics in Melbourne has moved to new premises in Centre Rd, Clayton. Their new postal address is PO Box 520, Clayton, Vic 3168.

● Texas Instruments recently reported that net sales billed (NSB) for the three months to June 30, 1980 were $1007 million. This is the first time that a single quarter result has exceeded $US1 billion, and represents an increase of 28% over the second quarter of 1979.

$12 million boost for geothermal power plan

The Camborne School of Mines in western England has received a grant of $12 million to investigate methods of controlled fracturing of underground rocks to release the heat contained in them. At depths of from 4000 to 6000 metres the Earth's core has heated the bed rock to very high temperatures, but the rock needs to be cracked open to expose large surfaces that will give off usable heat.

In Britain the necessary temperatures of at least 200°C have been found in rock at just over 6000 metres depth, although in some areas it is possible to find the required temperatures in granite at depths of only 4000 metres.

British engineers believe that the extraction of the heat can be a relatively simple process if the underground rocks can be broken open to expose large heated surface areas between two boreholes. Water can then be pumped down one borehole and steam extracted from the other.

The Camborne reseachers have demonstrated that suitable rock fractures can be made with a combination of controlled underground explosions and high water pressures. They have already achieved fractures that have successfully linked several boreholes. The next step is to establish whether the fracturing can be repeated at the necessary depth and whether the process can be controlled so that water can be passed through the fractures.

The researchers are working closely with the Los Alamos Scientific Laboratory in New Mexico, USA. Los Alamos scientists have already built a pilot plant which generates 60kW from granite lying just over 3000 metres below the surface.

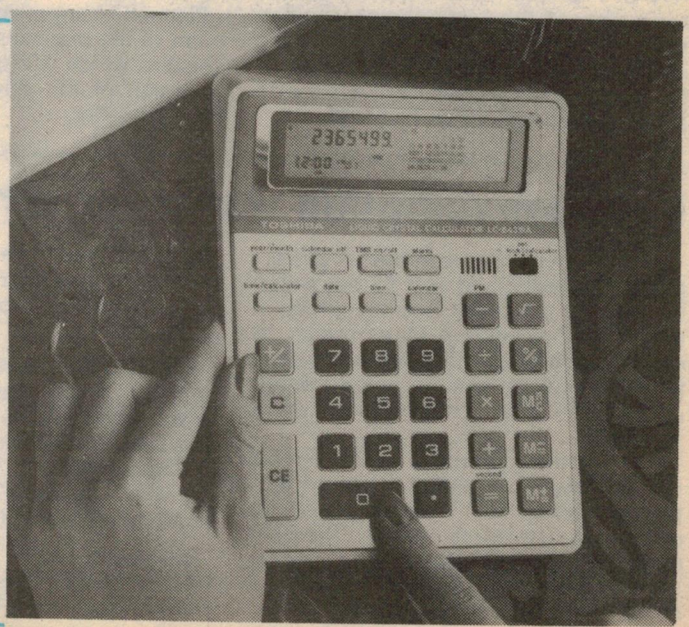
New desktop calculator released by Toshiba

Toshiba has introduced a new desk-top calculator which incorporates not only a range of calculator functions, but also features a built-in calendar, clock and alarm.

Aimed at the executive market, the new model, known as the LC-843WA, displays time, date, month and year simultaneously. It can, for example, determine the day of the week of any date in years past or future, and can display any year from 1901 to 2099. To complete the calendar's features, "today's" date flashes and the month is displayed in letters.

The LC-843WA has an LCD readout, 4 key independent memory, +/- sign change and square root and percentage keys. Its keyboard is generously sized, affording easy operation for a man's hand.

Dimensions are a compact 128mm x 40mm x 180mm (WxHxD) and weight is just 300g (with batteries). The unit will run for more than a year on two AA (penlight) batteries.



NEWS HIGHLIGHTS

Direct broadcast satellites for Europe

Britain could have Europe's first direct broadcast satellite in space by 1984 according to officials of British Aerospace. Experience with designing and building OTS, the European Space Agency's first communications satellite has given British Aerospace the ability to be first in Europe with a direct broadcasting satellite. Television pictures beamed to such a satellite would be bounced back to Earth and picked up directly in homes equipped with small roof-top dish antennas.

Direct broadcasting satellites (DBS) are planned by six European countries, and France and West Germany plan to have a DBS service in operation by 1985. British Aerospace hopes that the UK Home Office will give permission to go ahead with the British project later this year. The company plans a pilot scheme for two-channel direct broadcasting which could later be expanded to five channels.

The Orbital Test Satellite (OTS) is expected not only to be the forerunner of direct broadcast satellites but also the prototype for a series of European communications satellites. Five satellites are now being built to handle telephone traffic and television transmissions and the first is due to be launched in 1981.

British Aerospace has also announced plans to intercept Halley's Comet with a vehicle based on the British-built GEOS satellite. The Scientific Program Board of the European Space Agency (ESA) has already given its support to the project.

Halley's Comet circles the Sun once every 76 years, and was last seen in 1910. An early go-ahead for the project will be necessary if a vehicle is to be ready to rendezvous with the comet when it approaches Earth in 1986.

Comets are among the oldest bodies in the solar system, and their study can contribute markedly to understanding the processes of the system's formation. It is hoped that a vehicle to rendezvous with Halley's Comet can be launched in mid-1985.

First flight for solar-powered plane

The world's first solar powered plane made its maiden flight in Britain last year, and plans are now afoot to develop the craft further, with the aim of achieving a 50% increase in its efficiency.

Solar One, as the plane is called, flew just over a kilometre on its first flight, driven by four permanent magnet electric motors linked by a chain drive to produce a nominal 750W. A battery of 750 solar cells mounted on the top surface of the wings charges the batteries which drive the motors, providing sufficient power for the plane to climb for about eight minutes or cruise for 15 minutes at speeds of up to 65kph.

Solar One was designed by Mr Fredrick To, an architect who has had a long interest in solar cell technology. Since the first flight he has handed over development of the plane to the Cranfield Institute of Technology in eastern England. Students at the Institute examined the control and energy supply problems of the plane and concluded that the first version was not a practical proposition but could be further developed.

Planned changes include the replacement of the original solar cells with new versions which will supply more power, re-design of the driving motors and a new propeller.

Fuel consumption meter for vehicles

With some observers in the UK predicting that petrol could cost £2 per gallon by early 1981 interest is running high in methods of saving fuel. One obstacle to conservation has previously been the difficulty of quickly and accurately determining the fuel consumption of a vehicle.

Now a British company, EnviroSystems Pty Ltd, has developed a series of "instant" reading fuel consumption indicators to suit various engines. The FS20 (Fuelstretcher 20) provides a digital readout of fuel consumption, with a choice of two display update times, automatic clear when idling and simple calibration. Another low cost version gives a reading of total gallons consumed from reset.

The company points out that one advantage of the fuel consumption indicator is to show up defects such as binding brakes, incorrect tuning and incorrect tyre pressures, leading to fuel savings of as much as 20% with just a few simple adjustments to the vehicle.

EnviroSystems is at Hampsfell Rod Road, Grange over Sands, Cumbria, United Kingdom LA11 6BE.

Radar reflector for small boats

Small boats are often difficult to see in the water, and their low freeboard and wooden construction frequently make them difficult radar targets as well, causing many problems for navigators and port authorities.

Now a British company, Firdell Multiflectors, Ltd, believes it has found a solution to the problem: the "Blipper", a folded metal reflector moulded in a sealed plastic case. The reflector is totally passive and gives a consistent radar echo through 360° in all sea conditions. It uses no power and requires virtually no maintenance.

The Blipper measures 500mm x 230mm, weighs 1.7kg, and is designed to be attached to the masthead of sailing boasts or mounted on the superstructure of power boats. It can also be trailed on a line from a liferaft for easy detection by the radar of search and rescue craft.

Further details can be obtained from Firdell Multiflectors Ltd, 17 Old Street, London EC1V 9HL, England.

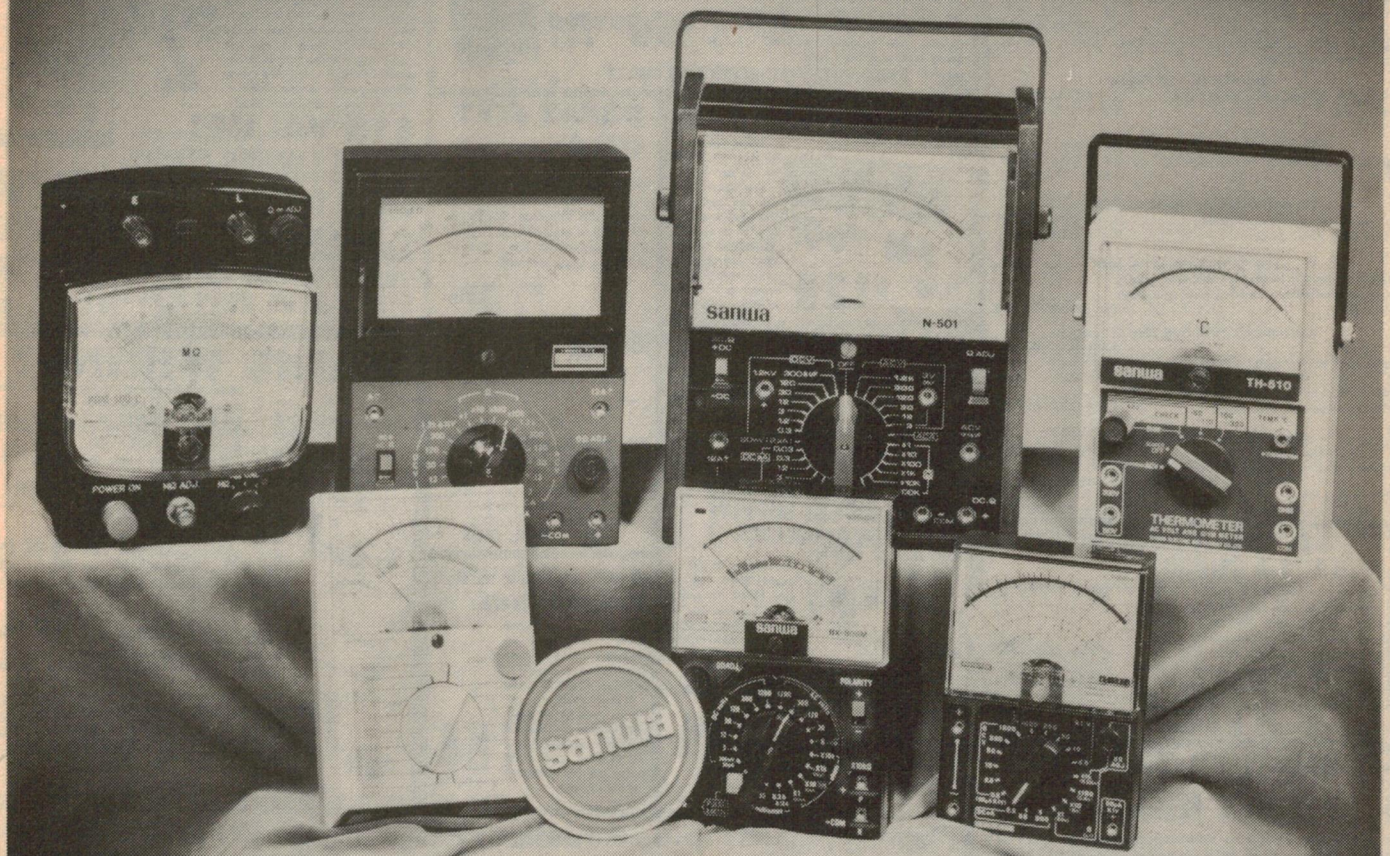
Arthur Cushen named DXer of the Year

Our shortwave correspondent, Arthur Cushen, was made International DXer of the Year at the Convention of the Association of North American Radio Clubs held recently in Los Angeles. This is the second time that Arthur has been honoured by ANARC – he was given the ANARC Man of the Year Award in 1967.

Ashes to ashes

Outdoor automatic bank tellers in Washington state have been hit by ash fallout from the Mount St Helens eruption. In one area, almost 40 machines will cost an estimated $25,000 to fix.

Spotlight on precision.



The Sanwa name has long been associated with high quality reliable test instruments and has gained wide acceptance in many areas including Telecom, military establishments, research, educational, trade and hobbyists. The above represents a selection of some of the more popular instruments from the comprehensive Sanwa power line up.

The "NO SWEAT" Insulation and Low Ω Meter

PDM 500c

- One man operation – no handle to crank.
- No wearing parts – solid state for long trouble-free life.
- Large easily read scale.
- Simple push-button operation.

High Performance – Rugged Construction

460 ED

- 10μA movement in a heavy-duty case.
- 12A A.C./D.C. measurement capability.
- Maintenance simplified with detachable indicator block.
- Polarity reversal switch.

Top of the Line – for Lab and Bench

N501

- VTVM performance with constant 1MΩ impedance on A.C.V. ranges.
- 2μA taut band suspension movement.
- High resolution of 0.05μA/1mV.
- Fuse and diode protection.

Hot Favourite for Temperature Measurement

TH-510

- Thermometer measuring –50° – 300°C in dual ranges.
- N-1 type accompanies a pointed tip probe. S2 type a flat tip probe for surface temperature.
- Constant voltage IC circuit.
- Minimal current consumption (3mA) increases service life of battery. 150-hour continuous use.

Low Cost 3-in-1 Logic Pulse Scale *NEW*

YX-380TR

- Instant L.E.D. indication of pulses in excess of 0.5 VRMS 0-30MHz (using optional probe).
- DC and AC simultaneously indicated on meter and logic probe.
- Multitester function may be expanded with optional hFE adaptor and HV probe.

Versatility Plus Sensitivity *NEW*

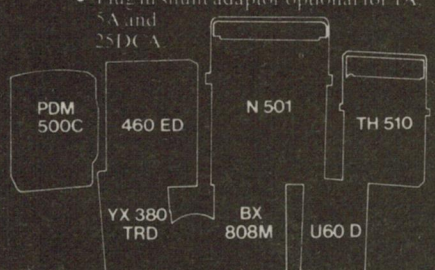
BX808M

- High sensitivity 30μA meter movement.
- Simultaneous measurement of A.C. and D.C. signals.
- A.C. signals may be measured even when mixed with D.C.
- Provides logic pulse analysis facilities with pulse and DCV range.
- Instant L.E.D. indication of pulses exceeding 0.5 RMS 0-30 MHz.

Popular Choice of Hobbyists & Servicemen

U-60D

- Easy to read wide scale.
- 44μA diode protected movement.
- Optional temperature probe for –30° to 150°C.
- Plug in shunt adaptor optional for 1A, 5A and 25DC A.



Available nationally from

WARBURTON FRANKI

• ADELAIDE (08) 356-7333 • BRISBANE (07) 52-7255 • HOBART (002) 28-0321
• MELBOURNE (03) 699-4999 • PERTH (09) 277-7000 • SYDNEY (02) 648-1711
• AUCKLAND N.Z. (09) 77-0924 • WELLINGTON N.Z. (04) 69-8272

PARTS FOR NEW KITS

If a kit you want to build is not listed, the parts may be available anyway. Check the Dick Smith Catalogue; or call in to your nearest Dick Smith store.

ACOUSTIC COUPLER (See EA September)
Complete kit, including metalwork, etc. .... Cat K-3605 $75.00
Printed Circuit Board only ..... Cat H-8380 $4.00

EXPANDED SCALE AUTOMOTIVE VOLTMETER (See ETI Sept.)
Printed Circuit Board ..... Cat H-8630 $1.50
LM3914 IC ..... Cat Z-6295 $4.25
Choose round or rectangular, large or small LEDs to suit your particular application.

CHASER (See EA August)
Complete kit, including front panel ..... Cat K-3145 $69.50
PCB only..... Cat H-8379 $5.95

NASA POWER CHOPPER (See EA August)
Short form kit (All components & PCB) ..... Cat K-3325 $16.50
PCB only..... Cat H-8378 $3.00

LEDS AND LADDERS GAME (See EA August)
Complete kit inc. printed panel ..... Cat K-3390 $15.75
PCB only ..... Cat H-8378 $3.00

LED TACHO (see ETI August)
Short Form Kit (includes PCB components etc, but no case – build it into your dash board). ..... Cat. K-3240 $24.50

FAST NICAD CHARGER (See ETI August)
PCB only ..... Cat H-8627 $3.00
(All other components in this kit are normal stock lines)

GUITAR/PA PREAMP (See ETI August)
Short form kit PCB & components, no transformer or case). ..... Cat K-3035 $29.50

300 WATT AMPLIFIER (See EA June)
Printed Circuit Board only..... Cat H-8376 $9.95
(Most other components are normal stock lines).

TV CRO ADAPTOR (See EA May)
Complete Kit ..... Cat K-3060 $29.95
Printed Circuit board ..... Cat H-8375 $3.75

IT'S A DIALLER! IT'S A CALCULATOR! AND IT'S A CLOCK!

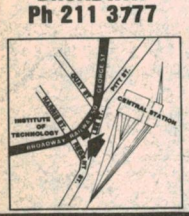
Great for busy executives, secretaries, or even in the home! It remembers 32 numbers for you, and dials them at the push of a button. But it's more than that. It is also a comprehensive memory calculator, and a clock: great for timing those STD & ISD calls!
Note: although this fits perfectly onto our phone system, present regulations do not permit them to be used in this way.

Cat. X-1176 **$179.00**

ANOTHER TWO NEW STORES NOW OPEN!

We're still expanding! A new store in up-town Sydney (near the Tech & Institute of Technology). And one in the heart of the Northern Beaches. Call in and compare our prices with others in the area!

818 GEORGE ST
BROADWAY
Ph 211 3777



531 PITTWATER RD
BROOKVALE
Ph 93 0441

DON'T FORGET: ONLY 11 WEEKS TO CHRISTMAS!!!

Need a few ideas for someone into electronics? Go no further than your nearest Dick Smith store!

LOWEST PRICE EVER!

16K MEMORY UPGRADE KIT SUITS ALL COMPUTERS!!!

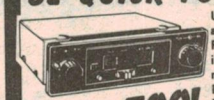
Fast (250nS) 4116 memory IC's for updating any microcomputer to 16K (or to 32K or 48K!) Complete with instructions for fitting – a huge saving over our previous price!

$59.95!!!

WAS $149 ONLY 12 MONTHS AGO!!

Cat X-1186

BE QUICK FOR THIS FM TOO!



Update your car sound: and save! This superb FM/AM/Car cassette is now $20 off: you reap the benefit of Dick's bulk buying! Easy to fit (goes in standard dash opening). Here's your chance to own a superb car sound system at a bargain price! (Speakers extra).

~~$149~~ **$129**

Cat. A-6480

GREAT GIFT IDEA . . .

It's the greatest teaching aid since the book! Children not only learn to say the words, they learn to spell them as well! Amazing microcomputer technology actually creates the sounds: no tapes! And with the plug-in modules (optional) the range of the speak-and-spell is greatly increased!

$79.50

Cat X-1300

PLUG-IN MODULES FOR SPEAK'N'SPELL

SUPER STUMPER I Cat X-1301
SUPER STUMPER II Cat X-1302
VOWEL POWER Cat X-1305
ALL $17.95 EACH

NEON TEST S DRIVER

You've often wondered if a circuit is live . . . Find out with this neon test screwdriver. If it has mains voltage applied to the tip, the neon lights. The rest of the time it's a handy screwdriver!

ONLY $1.00!!

Cat T-4005

NEED A SAFE AC SUPPLY FOR YOUR PROJECTS?

How about 12 volts at 500mA!!!!

Most plug-packs give you around 200mA. This one gives 500mA! The reason: it is ALL transformer. You put the recitifers, capacitors, etc, in the project: and plug in the AC supply. It's a great space saver!

$9.50

Cat M-9555

OUR PIECE DE RESISTANCE

YES! We now have good stocks in all values of our famous 1% metal film high quality resistors. These used to sell for around 35¢ each: look at our price!
They're great for all close-tolerance uses, and we have sufficient quantities to suit the OEM as well as the design lab, the technician and the hobbyist!

FROM ONLY 5¢
(per 100 up of same value)

WAVE A FLAG

What's an electronic store selling flags for, you ask? Dick couldn't buy one himself, so he thought 'I'll fix that!' Show your Aussie spirit and fly your own flag. 1 metre long.

$9.95

Cat X-1001

INCREDIBLE BARGAIN!

Superseded Amateur Radio Handbooks

WOW! We've made an incredible scoop purchase of Amateur Radio Handbooks direct from the publisher. These are the 1978 issues: the last of the ones that contain useful valve data! Great for novices, beginners, etc: here's your chance to own the amateur's 'bible' at a tiny fraction of the current price!

$2.50

$15 VALUE! Cat B-2217

HURRY! LIMITED STOCK!

NEW WIA CALLBOOK 1980 EDITION IN STOCK NOW! ONLY $2.95!!

Cat B-2319

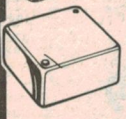
HUGE RANGE OF AMATEUR RADIO BOOKS ALWAYS IN STOCK!

MAINS WIRING?

These useful mains wiring aids from Dick Smith make the job that much easier . . .

WALL MOUNTING BOX
Accepts standard switch plates, power outlets, TV outlets, etc. Proud of wall; enough room for wiring & outlet, etc, within box.
$1.25 Cat P-5531

WALLBOARD CLIP
Great for fibrous plaster, fibro, masonite, ply, etc: lugs clip over wall board, power outlet screws on so it is flush with wall. Ideal for new installations in old buildings.
45¢ Cat P-5530



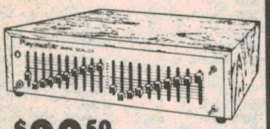
Junction Box
For mains cable connections; complete with connectors. As used by electricians, etc.
$1.40 Cat P-5625

DOUBLE POWER OUTLET: For new jobs or for converting singles. Takes same space as single
$4.70 Cat P-5560

POWER OUTLET SAFETY CHECKER
Check outlets easily and safely. 3 lights give instant good/bad reading.
$4.95 Cat P-5300

Playmaster Graphic Equaliser

A Playmaster Graphic equaliser in your hi-fi system will make so much difference you won't believe it! The graphic equaliser can boost or cut various bands of frequencies over the entire audio spectrum, allowing you to adjust the sound to make up for system deficiencies; or to make the sound the way YOU like it. If you want deep bass, you've got it. If you want high highs, you've got it!
A graphic equaliser in your system can make it sound like one costing twice as much!
The kit is very easy to build, and perfectly suits practically all hi fi amplifiers.



$99.50 Cat K-3500

THE PERFECT ADD-ON TO ANY HI-FI SYSTEM!

TIMBER SLEEVE SHOWN IS OPTIONAL. (Cat H-3113 @ $8.50)

DON'T WANT TO MAKE THE KIT? SEE THE BUILT-UP MODEL AT RIGHT!

Playmaster Graphic Analyser

- **ALSO DOUBLES AS A PEAK LEVEL METER!**

$99.50 Cat K-3510

GET THE MOST FROM YOUR SOUND SYSTEM!

TIMBER SLEEVE SHOWN IS OPTIONAL. (Cat H-3113 @ $8.50)

Like the horse needing the cart, the graphic equaliser needs a graphic analyser. This remarkable piece of equipment allows you to obtain the maximum performance from your graphic equaliser by setting the system up to suit the room and furniture exactly. You've probably noticed if you move your speakers around the room they sound different: the graphic equaliser can take care of this, but the graphic analyser tells the equaliser what to do!
And when you've set up your system, the graphic analyser isn't wasted: flick a switch, and it becomes a superb peak level reading meter – a mini light display playing along with your music!

MAJOR DICK SMITH RE-SELLERS:

Listed below are re-sellers who stock a large proportion of our range. However, we cannot guarantee that they will have any or all of the items, or at the same prices, as those advertised on these pages.

ATHERTON, QLD: Tableland Radio Service
2 Jack Street. Phone 912 017

BAIRNSDALE, VIC: Odyssey Electronics
101 Main Street. Phone 525 282

BENDIGO, Vic: Summer Electronics
95 Mitchell Street. Phone 431 977

BLACKHEATH, NSW: Goodwin Electronics
123 Station Street. Phone 878 379

BROKEN HILL, NSW: Crystal TV Rentals
66 Crystal Street. Phone 6897

COFFS HARBOUR, NSW: Coffs Harbour Electronics
3 Coffs Harbour Plaza, Park Ave. Phone 525 684

DARWIN, NT: Kent Electronics
42 Stuart Highway. Phone 814 749

FAIRY MEADOW, NSW: Trilogy Wholesale Elect.
40 Princes Hwy. Phone 831 219

GEELONG, VIC: Electrofix
133 Malop Street. Phone 97 827

GERALDTON, WA: KB Electronics & Marine
361 Main Terrace. Phone 212 176

GOSFORD, NSW: Tomorrow's Electronics & Hi Fi
68 William Street. Phone 247 246

HOBART, TAS: Aero Electronics
123a Bathurst Street. Phone 348 232

KINGSTON, TAS: Kingston Electronics & Records
Channel Court. Phone 296 802

LAUNCESTON, TAS: Advanced Electronics
5a The Quadrant. Phone 317 075

LISMORE, NSW: Decro Electric
Cnr Magellan St & Bruxner Hwy. Phone 214 137

MACKAY, QLD: Stevens Electronics
42 Victoria Street. Phone 511 723

MARYBOROUGH, QLD: Keller Electronics
218 Adelaide Street. Phone 214 559

MORUYA, NSW: Coastal Electronics
43 Vulcan Street. Phone 742 545

MT GAMBIER, SA: Hutchesson's Communications
5 Elizabeth Street. Phone 256 404

MUSWELLBROOK, NSW: Silicon Chip Electronics
Suite 3, 98 Bridge Street. Phone 43 1096

NAMBOUR, QLD: Nambour Electronic Shop
Shop 4, Lowan House, Ann St. Phone 411 604

NEWCASTLE, NSW: Elektron 2000
181 Wharf Road. Phone 282 644

NOWRA, NSW: Lyrebird Electronics
50 Berry Street. Phone 25 525

ORANGE, NSW: M&W Electronics
48 McNamara Street. Phone 626 491

ROCKHAMPTON, QLD: Purely Electronics
15 East Street. Phone 21 058

SOUTHPORT, QLD: Amateur's Paradise
121 Nerang Street. Phone 322 644

SURFERS PARADISE, QLD: Viking Electronics
3108 Gold Coast Hwy. Phone 322 644

TAMWORTH, NSW: Sound Components
78 Brisbane Street. Phone 661 363

TOOWOOMBA, QLD: Hunts Electronics
18 Neil Street. Phone 326 944

TRARALGON, VIC: Power'N'Sound
15 Franklin Street. Phone 743 638

VINCENT, QLD: Tropical TV
249 Fulham Road. Phone 791 421

WAGGA, NSW: Wagga Wholesale Electronics
82 Forsyth Street.

WALGETT, NSW: P.J. O'Brien Electronics
62 Woo Waa Street. Phone 243

WINDSOR, NSW: Hawkesbury Electronic Centre
111 George Street. Phone 773 411

WODONGA, VIC: A & M Electronics
78a High Street. Phone 244 588

WHYALLA NORRIE, SA: Mellor Enterprises
Shop 2, Forsythe Street. Phone 454 764

BUYING BY MAIL?

ORDER VALUE:	P&P
$5 (min) to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post.
If you prefer, we will despatch your order by Comet Road Freight to anywhere in Australia for only $6.00 – that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air – you pay freight on delivery.)

DICK SMITH ELECTRONICS

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842 Gympie Road
Ph (07) 59 6255

CANBERRA

96 Gladstone Street
Ph (062) 80 4944

ADELAIDE

60 Wright Street
Ph (08) 212 1962

PERTH

414 William Street
Ph (09) 328 6944

DICK SMITH'S GUIDE TO SORCERER BASIC & SYSTEM 80 BASIC

NEW!

$9.95 EACH

Yes – you asked for them, so here they are. Written in language anyone can understand, and they start at the basics (like how to turn it on!). Now there are two books, similar in content, but each written specifically for its own computer system. The first is for the superb Exidy Sorcerer, the second is for the incredibly popular Dick Smith System 80 (but it also applies to the TRS-80). If you don't know what a computer is all about, then these books will help you understand.

CAN YOU BELIEVE IT?

A 3 channel, digital proportional radio control system, complete with servos, and it's less than $100

Cat X-1230

That's right: compare this little beauty with similar models elsewhere. You get the transmitter, receiver, battery pack and three servos, as shown, for less than $100!!! We've never seen these for less than $150.00 before!

It's the ideal system for model planes, boats, cars, etc etc: each channel is individually proportional controlled and has a preset position on the transmitter to allow for trimming, mechanical wear, etc. Our initial shipment is limited: so hurry in for this if you're at all interested in radio control (or would like to be!)

AND THE PRICE? JUST $99.00!!!!

A 15MHz DUAL BEAM CRO FOR ONLY $638?

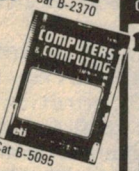
Yes! This superb Hitachi 15MHz CRO offers dual beam capability, high (1mV/div) sensitivity; X-Y operation, trace rotation, Z-axis input, 10x sweep magnifier, and five modes of vertical deflection operation! It's a superb piece of craftsmanship; way ahead of its opposition!

TERMS AVAILABLE TO APPROVED APPLICANTS.

Cat Q-1242

TOO NOO COMPOOTER YEARBOOKS

From Elect. Aust. 'MICROPROCESSORS & PERSONAL COMPUTERS' 112 pages of data on computers, allied equipment, etc, plus background info. $5.00 Cat B-2370



From Elect. Today Int. Computers and Computing Yearbook 154 pages, with system reviews, projects to build etc, plus glossary, technical tips, market guides, etc. $4.95 Cat B-5095

HUGE RANGE OF OTHER COMPUTER BOOKS IN STOCK: JUST ASK!

PROGRAMMERS

WANTED: Free-lance programmers familiar with TRS-80 level II BASIC to write customised software packages for us.

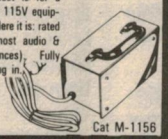
If you are a Uni. student, tutor, lecturer, computer programmer, professional person or a microcomputer buff and you own a System 80 or TRS-80 and enjoy programming in BASIC, why not take this opportunity to make some extra money in your spare time by writing various software for us?

Give us a call: you have nothing to lose, but plenty to gain.

Call Mark Sim, on (02) 888 3200

115V PROBLEMS?

A very common request is for a transformer to operate 115V equipment from 240 volts. Here it is: rated up to 60VA (suits most audio & entertainment appliances). Fully approved, ready to plug in.



$42.50 Cat M-1156

NEW RANGE OF SOUND CARE EQUIPMENT JUST ARRIVED!

You asked for it: so here it is! Economy sound care equipment that will do a really professional job on your records and cassettes. Something for everyone, at a bargain price!

Cassette winders, labels and reel locks. Cat. C-7086	$2.95
Cassette head care kit. Cat C-7088	$2.95
Cassette head demagnetiser and cleaning fluid. Cat C-7090	$4.50
Deluxe record cleaner. Cat C-7092	$3.95
Deluxe record cleaning arm and brush. Cat C-7094	$4.95

WOTTA BARGAIN!

We've just bought a HUGE shipment of these incredibly popular push button telephone dials in – so our cost has dropped. You reap the benefit of Dick's huge bulk buying power!

Simply substitute for any rotary dial. Although these units fit perfectly into standard Aust. phones (no soldering required) current regulations do not allow you to use them for this purpose. Cat X-1175

NOW: $39.50

COMPUTER MAINS FILTER

Don't lose that important program through mains spikes. This filter effectively smoothes the mains supply, resulting in less 'crashes'. A must for all serious computer users; businesses, etc.

$75 Cat M-9850

More of Dick's

BONZA BULK BUY BARGAINS: BEWDY!

We admit it: we blew it! A mistake on our order has left us with red faces: and a couple of thousand wrong switches! We can't send them back, so we've slaughtered the price just to get rid of them! They're five position, single pole switches, which can also be used as two, three or four position: just ignore the extra positions. They would normally sell for around $1.50: look at the price now! Thousands of hobbyist uses – buy now while stocks last!

Cat S-2315 55¢!

And another bulk buy switch bargain: this one is the most popular we stock: DPDT mini toggle switch, with contacts rated at 125V 10A (but great for 240V at lower current). As used in just about every EA & ETI project! Normally $2.25 each, because of our HUGE bulk purchase, the price has been slashed to just $1.75! (Or $1.50 for ten or more!) Cat S-1168 $1.75!

How's this for a bargain: a superbly made 4PDT relay with 12 volt (185 ohm) coil at near half price! Yes, hundreds of uses for the professional, the hobbyist and the experimenter. And for 10 or more, the price drops to just $2.50 – incredible! Cat S-7000 $2.90

Unbelievable price: Famous quality Memorex reel-to-reel tape at pre-1974 prices! Yes, 2400 ft Memorex tape on 7" reel, in box, for around 1/3 off current price while stocks last. Cat C-3406 $9.95!

BIG PRICE CUT ON 5¼IN DISKS

High quality 5¼ inch (sorry, Metric conversion board!) diskettes for all disk drives at a new low bargain price. Both hard and soft sectored; with **huge** savings for quantity buyers, too! And they're now in stock: so hurry before you miss out!

Hard Sector: Cat X-3505 (Suit Microp. type)
Soft Sector: Cat X-3510 (Suit Pertec type)

WERE $5.95 EACH – NOW:	1 TO 10: $4.95!
	10 TO 100: $3.95!
	OVER 100: $3.50!!!

INCREDIBLE QUALITY SOUND from such a tiny speaker!

You'll find it hard to believe that such good sound can come from such a small speaker! They're ideal for cars, vans boats etc, and, of course, for extension speakers around the pool, in the rumpus room, etc etc. They're made of heavy aluminium, with a tweeter and a woofer in each enclosure. Yet the size is only 120 x 120 x 190mm! They come complete with mounting brackets and spring-loaded connecting terminals. Check them out soon!

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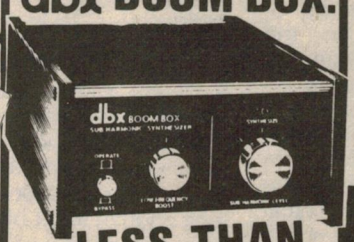

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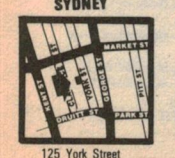

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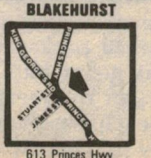

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Do-it-yourself all you

With so many passionate causes to espouse, many terrorists are interested in acquiring their own atomic bomb. This article outlines the construction of a device which should satisfy even the most fanatical terrorist and make a plane hijack look like a Sunday school picnic. Construction is simple — in theory . . .

by GEORGE HARPER

American freelance writer and physics teacher in Dakoma, Washington.

The theory of an A-bomb is simplicity itself. Merely take two masses of the right material — usually either uranium-235 or plutonium — and hold them tightly together for a long enough period of time. Everything else occurs on its own.

For the purposes of this article I shall focus attention on the sort of bomb that can be constructed in an ordinary home. In this type of bomb the amount of U-235 required should be in the neighbourhood of 15kg . . . about the size of a baseball. Employing only easily acquired material, this type of bomb should be capable of demolishing everything within a radius of ½km from ground zero and causing extensive damage out to a distance of 1km. Lethal exposure to radiation could occur within a radius of 1.4km and people downwind of the fallout might be sickened up to a distance of 60 or 80km.

All in all, it would seem a most satisfactory device which, if detonated in New York City, ought to kill perhaps 250,000 people and injure another 400,000. I believe this should be more than adequate for the average terrorist and very possibly even satisfying to a general . . . providing it was put in the right place.

But I would caution against the employment of masses of U-235 exceeding some 20kg. Beyond that limit the problem of putting the pieces together in a timely and efficient manner becomes too great for amateur mechanics. It would be unfortunate if you started building one of these things and it went off in your face before you finished it. My personal preference, therefore, would be a total mass of around 16 or 17kg. This will provide a comfortably large bang while also leaving a certain margin for errors of calculation in constructing the gadget.

Once an adequate amount of material has been put together in one place there is a need to keep it there for about half a second. The method of achieving this half-second delay is the main problem confronting the manufacturer.

Whenever two masses which together will create a critical mass happen to get too close they begin a rather violent interaction. The immediate effect of this interaction is the appearance of massive quantities of energy . . . all pushing outwards. In a small fraction of a second this energy will fling the two masses of U-235 apart. The sole result of such an unconstrained approach is a *squib explosion* . . . one which will make a mess of the immediate area but will scarcely be felt 100 metres away. It is assumed any self-respecting terrorist would wish for something more spectacular, so the immediate task is one of devising some method which will keep the two masses of U-235 together long enough to let bigger things happen.

A quite acceptable device can be constructed providing the terrorist has access to a two-storey building with basement, two sticks of dynamite (or the equivalent in black powder or TNT), 15 sacks of cement, 20 cubic metres of sand and gravel and about a week to work. Total cost, apart from building rental, should be in the vicinity of $3000 — perhaps a bit less if second-hand or surplus materials are used. The final requirement, which is a bit more difficult to come by, is the necessary quantity of U-235 or plutonium. I shall touch on this matter later, but for the time being I shall merely assume the U-235 is on hand.

Taking things in order, the first step is to make certain the U-235 is divided into two or more approximately equal masses. Rather obviously, it was not all together when brought into the house, so we shall assume that it arrived in several small packages. The immediate task is to get it into a form ready to become part of an explosion. With two masses, each weighing 8 to 8.5kg, it is necessary to machine a pair of matching hemispheres. This requires an acetylene torch.

Uranium has a melting temperature of approximately 2070°C. An acetylene torch has a theoretical flame temperature of 2630°C, and even though this theoretical limit is not reached, the flame temperature is still comfortably above the melting point of uranium. Preferably you should first construct a small kiln out of a few dozen fire bricks and employ a bellows to add air to the system, but with a bit of patience (and some luck as uranium happens to be explosively flammable) the acetylene torch ought to be entirely adequate.

As the uranium melts it is allowed to flow into a hemispherical depression created out of fire clay of the sort obtainable in any ceramics outlet. Once the first hemisphere is formed and cooled it can be moved away from the kiln and the second hemisphere manufactured. It must be noted that in doing this it is highly desirable to stay well clear of the area. Uranium has a number of unpleasant characteristics. If you happen to be in the same room while it is being melted down you are certain to inhale some of the radioactive gases . . . More than enough to have a decidedly adverse effect on your life expectancy; possibly reducing it to as little as a few hours.

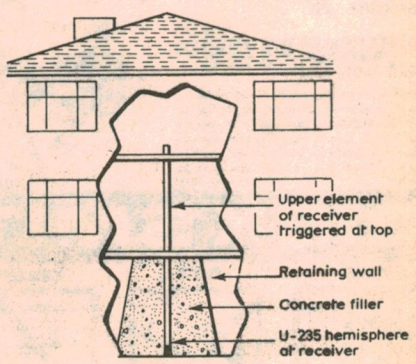


Fig. 1: A two-storey building is an ideal place to build the bomb.

atomic bomb?

need is a river + U-235 + ...

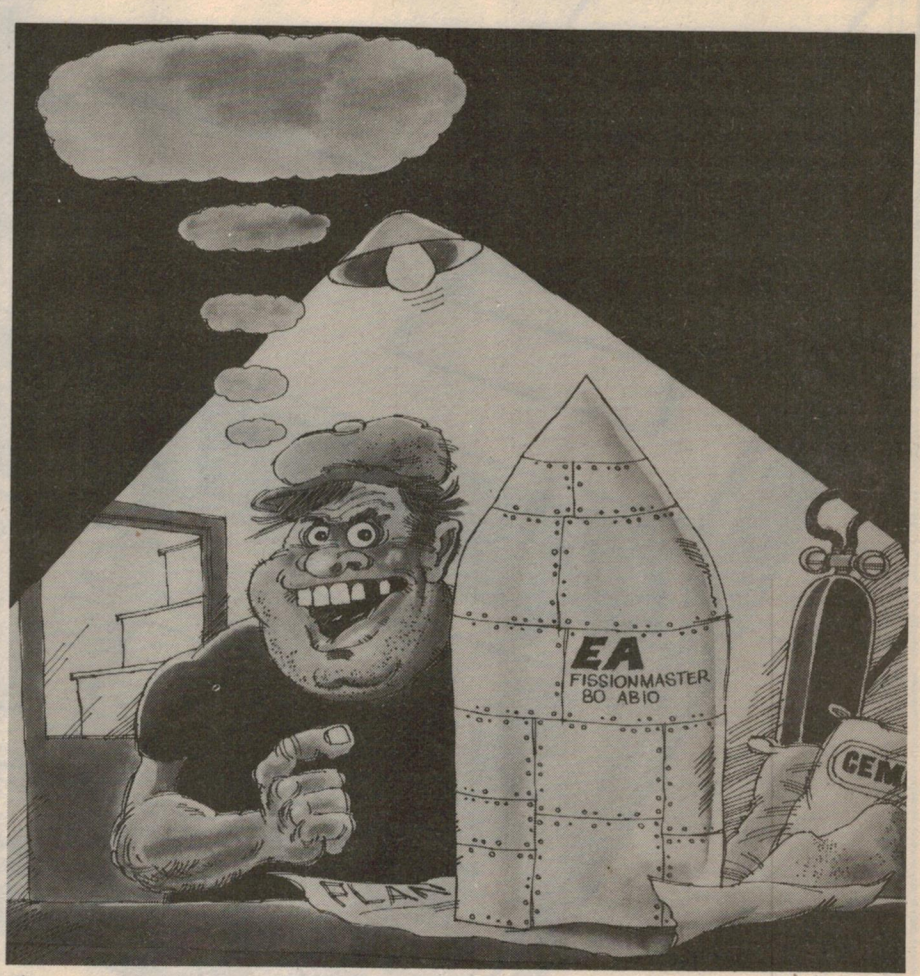
Appropriate Precautions

Assuming that as a terrorist you are not overwhelmingly interested in personal survival, these matters can be neglected providing you are willing to hurry a bit. Otherwise, to smelt the uranium I would suggest you employ some reasonably good servo-mechanisms, about five tonnes of lead and a distance of some 20 metres or so between you and the U-235 being smelted. Given this sort of protection there should be no problem, providing appropriate peripheral precautions are taken.

Keeping the two chunks of U-235 well separated from one another (and in a lead casket to prevent excessive stray radiation while you are about the business of completing the bomb), you next cut a hole from the second floor down to the basement. A couple of lengths of black iron pipe are now inserted and joined so you have a 7.5cm cast pipe running from the basement up to the first floor. This should give about six metres total length.

Probably it would be a good idea to put about a 15cm plug of cement in the base of the pipe, but if your floor is very solid and the house rests on rock this may be dispensed with. Before lowering the pipe onto the plug you put one of the U-235 hemispheres, flat side up, atop the plug. The pipe is then seated and the first half of the bomb is complete.

To assist in providing confinement you next fill the basement with a mix of sand, cement and gravel mixing thoroughly with water from a hose in the process. Because this is to be a one-time job, there is no need to make a real production of the matter. Slopping it together will do almost as well as trying to be meticulous about the whole thing. What you are really interested in is having enough external resistance around the pipe to prevent it from rupturing and scattering uranium around the basement before having it go boom. Even a semiliquid cement-sand-gravel mix will be adequate for the purpose and any additional strength will be largely wasted.



The assembled bomb, as visualised by staff artist Garry Lightfoot.

I would also suggest that a few sacks of cement and sand be placed around the pipe where it passes up through the ground floor. This is probably not really necessary but a little extra containment may well pay off in a higher yield. When finished, this completes the receiver element of your bomb and the structure should look about as sketched in Figure 1.

Construction of the firing element is a trifle more difficult. The idea is to take the second U-235 hemisphere and place it at the top section of the pipe so it can be fired downward onto the receiver element. While the theory is simplicity itself, there are certain inherent difficulties. For one, it would be somewhat disconcerting if the trigger hemisphere slipped during the final positioning. Lacking anywhere else to go, it would promptly slide down the

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Do-it-yourself atomic bomb — minor problems

pipe and then come back up again. This would be self-defeating. Not only would you be dead, the publicity would be unfortunate. Terrorists who succeed only in blowing themselves up are merely amusing and not at all terrible.

Our design, as given in Figure 2, is probably the simplest effective approach yet devised. A thin wire screen – the same sort used to keep out flies in the summer – is placed atop the bell of the pipe and then stuffed loosely down into it, taking care that 7 or 8cm of the screen remains outside the lip of the bell. A 1.3-metre additional section of pipe is then seated on top of the bell and welded firmly into place. For additional strength I would also suggest that one or two small holes be drilled into the joined sections of the pipe and steel pins inserted.

Next you take a 1-metre length of 6cm copper pipe and fill it with molten lead. The second hemisphere of U-235 is then pinned into a form-fitting recess moulded at the base of the lead while a steel screw-rod is drilled into the opposite end of the cylinder for a distance of perhaps 30cm. The total mass of this firing unit will be between 36 and 42kg, depending on the amount of lead employed and the length of trigger pipe used.

A threaded cap is then screwed onto the pipe (note the need to tap threads onto the pipe before affixing the cap). When the cap is loose enough on the threads that you can screw it on and off by hand it is then removed and a hole large enough to accommodate the heel rod of the trigger unit is drilled through it. Allow some 15 to 20cm of freedom and drill a small hole in the heel rod, making it just large enough to accept a small nail.

Several nail sizes should be tried. The optimum size is a nail barely large enough to hold the complete trigger when the cap is suspended with the complete unit hanging from it. *(Note:* This should *not* be tried atop the receiver pipe!) Once such a nail has been found you are ready for final assembly. The TNT or gunpowder is flaked and placed on a small tray – ideally a coffee grounds holder from a small percolator. The flakes or powder should be carefully tamped into place and either one or two electric primers inserted. This is placed around the heel rod with a pair of firing wires running up from the primers to the outside of the unit. The whole assembly is now screwed on and your A-bomb is complete. The wires are attached to a timer switch and the lower safety pins are removed. You now have some 12 hours to leave town before the town leaves.

When the timer detonates, the charge provides far more than enough force to shear the retaining pin and drop the trigger down onto the receiver. Further, the force of the timer detonation should be fully adequate to keep the two hemispheres in contact long enough to provide a very satisfactory bang.

Minor Problems

But in fairness to all concerned, I ought to mention a few minor problems which should be considered by anybody wishing to put one together. For example, I touched briefly on the flammability of uranium when I mentioned the acetylene torch. I should point out that *any* machining should be performed under a "milk" bath. "Milk", for those not knowledgeable of machining techniques, is a milky-appearing substance having many of the properties of oil but lacking its flammability. It is readily obtainable from any distributor of machine shop supplies with no questions asked. Use of this "milk" will tend to minimise risk.

Actually, it would be better if the uranium were melted and machined in a pure nitrogen atmosphere, but with care and a bit of luck you will most likely be able to manage without going to any such extremes.

The radiation problems are a bit more difficult to handle. U-235 has certain

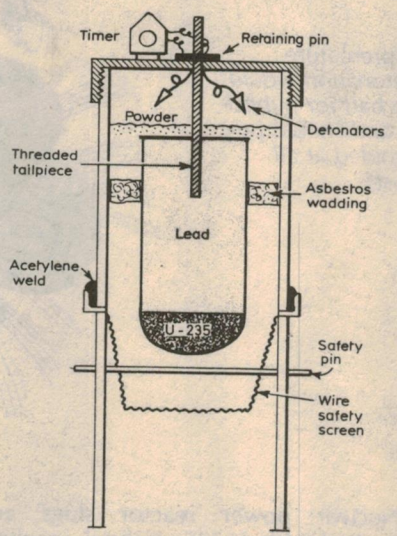

Fig. 2: the trigger mechanism (Figs. 1 & 2 courtesy of "New Scientist").

expotentiation characteristics which cannot be ignored. Assume for a moment that one gram of radium has a characteristic radiation constant equal to x. Two grams of radium would then have a radiation constant of $2x$. Three grams would equal $3x$, and so on. With either U-235 or plutonium this is not the case. It is this precise characteristic which makes them explosive while radium is not. While one gram of U-235 may have a radiation constant of $1x$, two grams might turn out to have a constant of $2.5x$, and three grams could well top $6x$, etc. This can be a problem.

Because each of your hemispheres are in excess of half the critical mass they are *HOT!* Simply staying in the same room with one of these units for more than a few minutes is apt to be highly lethal. Inhaling air containing dust motes made radioactive by the U-235 is a reasonably quick way of saying goodbye to the world. For these reasons I would suggest some independent air supply for those working around the material. Possibly scuba gear could be used to solve the breathing problem. Solving the general radiation problem is a trifle more difficult, but with a bit of determination, some ingenuity and some luck it should be achievable.

Lead Wheelchair

I would suggest something on the order of a lead-encased, powered "wheelchair" which can be moved around the room with the operator sitting securely inside. A small slit, covered with leaded glass, provides the needed visibility. Leaded sleeves and gauntlets will permit the operator to perform any needed mechanical actions involving the U-235 providing he is cautious and spends no more than a few minutes at a time working with the material. As an added security against stray radiation I would also suggest the laboratory be lead sheathed on both walls and floors. The basement ceiling should also be shielded with lead to avoid problems with the radiation from the receiver element. In all, probably about six to eight tonnes of lead would have to be used if even a minimal security is to be maintained. Since such a weight would have to be fairly concentrated it would probably also be necessary to shore up the flooring so the building doesn't collapse.

Once these precautions are taken, however, you should be well prepared to go about building your bomb.

There is still one more problem though: an old recipe for rabbit stew begins with the practical injunction "first catch your rabbit". Similarly, if you are going to build an A-bomb you had better get your U-235 or your plutonium. Since plutonium is a bit more difficult to lay hands on than U-235, I shall begin by assuming you want to take the easiest approach and will concentrate on U-235.

In this your task may have been made far simpler because any number of newspapers and other scientific commentators have repeatedly pointed out that the best available source of U-235 is the local nuclear power reactor. All that's necessary is to go in and steal a few of the control rods, smelt them

Do-it-yourself atomic bomb

down, purify them to eliminate the non-explosive U-238 and then build your bomb.

Getting into the reactor complex is probably reasonably easy. Most campuses are only moderately guarded. Usually there is a cyclone fence of some sort and one or two security guards at the gate. It might be advisable to do a bit of discrete checking in advance to determine whether there are electronic guard devices around the grounds, but usually this is not the case. In ordinary circumstances, there is no point in trying to come in by the back way anyhow. Uranium has a rather considerable mass and no one person, nor even a group of several people, is apt to be able to carry out enough uranium reactor slugs to make much of a difference – particularly since he/she would have to be wearing protective armour to minimise the radiation hazards.

As I see it, the best approach is the most direct. Simply steal a truck and semi-trailer and drive right up to the gate. Take out the guards, leave a couple of your own people as substitutes and drive right up to the reactor building, remove what you wish and depart. Very simple, very direct and highly effective.

But there are a few minor problems here too. The actual reactor itself is cased in a nickel-iron sphere which is immersed in a water coolant/moderator. As every reactor has crane hoists and servo-mechanisms for use in working on the reactor during maintenance periods at least a part of the problem is already solved. This equipment can be used to pick up the reactor core and slide it over onto a powered dolly which can then load it onto the truck.

One note of caution here: if you merely hoist the reactor sphere without pulling a few of the reactor slugs or inserting the appropriate dampers it will not be possible for you to load the device onto your truck. You will be dead in a minute or two and the whole reactor will be a puddle on the floor. For this reason I would suggest you take a prisoner or two and have them instruct you in the proper technique for pulling the core and removing the reactor unit.

Additionally, it would be wise to have your semi-trailer specially modified before you ever take it in. Total weight of the system being removed is somewhere in the vicinity of 50 tonnes, and because you would have to have at least 15cm of lead shielding inside the trailer to protect the driver in the cab, the total cargo weight would gross out at about 65 tonnes. The need for additional support members in the trailer is obvious.

Alternatively, if removal of the whole core unit seems impractical, and if the power plant has enough spare slugs available, you might simply remove about 550kg of reserve slugs and load them onto the truck. This is quite a bit easier, but you cannot neglect to carry along enough moderating material – either graphite or lead – to prevent the slugs from building up heat and melting through the bottom of the truck. It would be embarrassing if you got all the way home and then discovered the bottom had melted out of the truck and the contents were scattered in a radioactive straight line all the way to your hideout. As you would probably already be dying of radioactivity poisoning by now there would be little the police could do to make things worse – but it would still be an ultimate humiliation. So grab the 550kg of spare slugs and mix them with about 700kg of graphite and lead. This way you should get home safely.

A premature detonation would be bad for publicity and should be avoided at all costs.

Nuclear power reactor slugs are *enriched* with U-235. Natural uranium consists of some 99.5% U-238 and some 0.5% U-235. When prepared for use in a reactor the U-238 is mixed with enough U-235 to bring the U-235 fraction up to about 3%. This is a very considerable improvement, but it is not even approximately good enough to give you a bomb. Bomb grade uranium *must* consist of at least 97+% U-235, otherwise it simply *cannot* explode. It will get hot at 3%. If enough of the 3% mix is piled in one spot it will boil away merrily and ultimately blow itself around the room, but there is no way it can give you a genuine A-bomb. To get one of those you have to refine the U-235 out of the mix.

The 550kg of enriched slugs you acquired can be expected to provide you with the needed 16kg of U-235, providing you have the time, the patience and the expertise to separate it all out. Should you have any doubts of your ability to perform a total separation you should plan in advance to increase the number of slugs removed from the power plant accordingly.

Generally, with the best current techniques and several passes of the material, a refining efficiency of 25% is easily achievable. To go above that requires materials and equipment not normally available. This would suggest you ought to abduct a minimum of 2200kg, with 4400kg being an optimum target. Together with the shielding necessary to transport all this mass of uranium with a degree of safety you should figure on a total mass in the order of 75,000kg, or 75 tonnes!

Presuming this has been taken care of and you now have secure possession of approximately five tonnes of uranium slugs, you next have the problem of finding some place (or places) to store them while you set about extracting the needed U-235. For this I suggest you rent a small warehouse and move your operation there. You may keep your two-storey building as your ground-zero site. But it is showing signs of being a trifle impractical as a refinery, particularly in view of the difficulty of

separating the two isotopes of uranium. As a good estimate, you should probably figure on acquiring a structure containing a minimum of 2000 square metres of floor space if you are serious about going into the business of uranium refining. It is simply too difficult to cram the needed equipment into any smaller space. After all, if it takes hundreds of hectares to refine out U-235 at such places as Oak Ridge or Hanford, I hardly feel I am out of line in settling for a scant 2000 square metres here. You will be cramped but it should be possible.

Now that you have your floor space you have to decide which technique you are going to use to separate out the U-235. Several of these are now available, but they tend to be mutually exclusive so you must pick one at the beginning and stick with it throughout.

Gaseous Diffusion

As a terrorist, one of the best methods for your purposes is the gaseous diffusion approach. This was the one used for the earliest A-bombs, and in many respects it is the most reliable and requires the least sophisticated technology. It is, however, a bit expensive and does require certain chemicals apt to raise a few eyebrows.

You have to start with something on the order of 20km of special glass-lined steel tubing and about 60 tonnes of hydrofluoric acid which can be employed to create the compound *uranium-hexafluoride*. Once your uranium has been converted into hexafluoride it can be blown up against a number of special low-porosity membranes. The molecules of uranium hexafluoride which contain an atom of U-238 are somewhat heavier than those containing an atom of U-235. As the gas is blown across the membranes, more of the heavier molecules are trapped than the light ones. The area on the other side of the membrane is thus further enriched with the U-235 containing material; possibly by as much as 0.5% per pass.

Repeat this enough times and you wind up with uranium hexafluoride containing virtually 100% core atoms of U-235. You then separate the fluorine from the uranium and arrive at a nice little pile of domesticated U-235. From there it's all downhill.

As hydrofluoric acid is expensive, and probably difficult to obtain without somebody asking the wrong sort of questions, it would be best to steal it if you are genuinely determined on this method . . . either that or steal a few million dollars first, then set up your plant as cover and not bother getting the uranium until you are ready for the final phase.

Alternatively, if you decide the gaseous diffusion method is too cumbersome, you might merely construct a breeder-reactor pile somewhere out in the woods and use the enriched uranium to create plutonium. The plutonium could then be separated out by purely chemical techniques thereby avoiding the difficulties of the gaseous approach.

Setting up a breeder pile is simplicity itself, and any of a dozen easily obtained college texts will spell out equally good methods so there is no need to go into them here. Suffice it to say there are no theoretical problems in putting a breeder reactor together. There may be a few practical problems – but if you happen to have access to a small, private river, a few train car loads of sodium, a considerable quantity of stainless steel tubing and about 40 hectares of secluded land you should be able to manage it nicely.

Should neither of these approaches appeal to you, you might consider trying your hand at some of the interesting new techniques for isolating U-235 out of a conventional mix. One of these, for example, *starts* with a requirement for a cryogenic magnet capable of sustaining a 20,000 gauss flux inside a liquid helium bath. From there it starts getting complicated. A simpler approach utilises a laser separation technique. U-235, being lighter in mass than U-238, departs with a slightly different vector when excited by a laser beam. You spray a thin mist of uranium atoms at right angles through a laser beam. The U-235 is driven out at a somewhat steeper angle than the U-238.

In principle it is easy and reliable. It is, however, a bit slow. Using any readily obtainable laser you could probably process as much as 9kg of uranium per day with a 12.5% efficiency. The resulting mix at the U-235 end, would probably run about 10% U-235 after the first pass, so a total of nine separate runs would be needed if the material is to reach bomb grade. Assuming you started with 4320kg of slugs you should be able to come up with the needed 16kg of 97+% pure U-235 in just under four years. Almost certainly you would have picked up a lethal dose of radiation during the initial theft and transfer phases of the operation, so you would not *have* four years to complete the refinement. On this basis it would probably be wise to have at least one, and preferably two or three backup crews of volunteers to replace you and your original crew as you die off.

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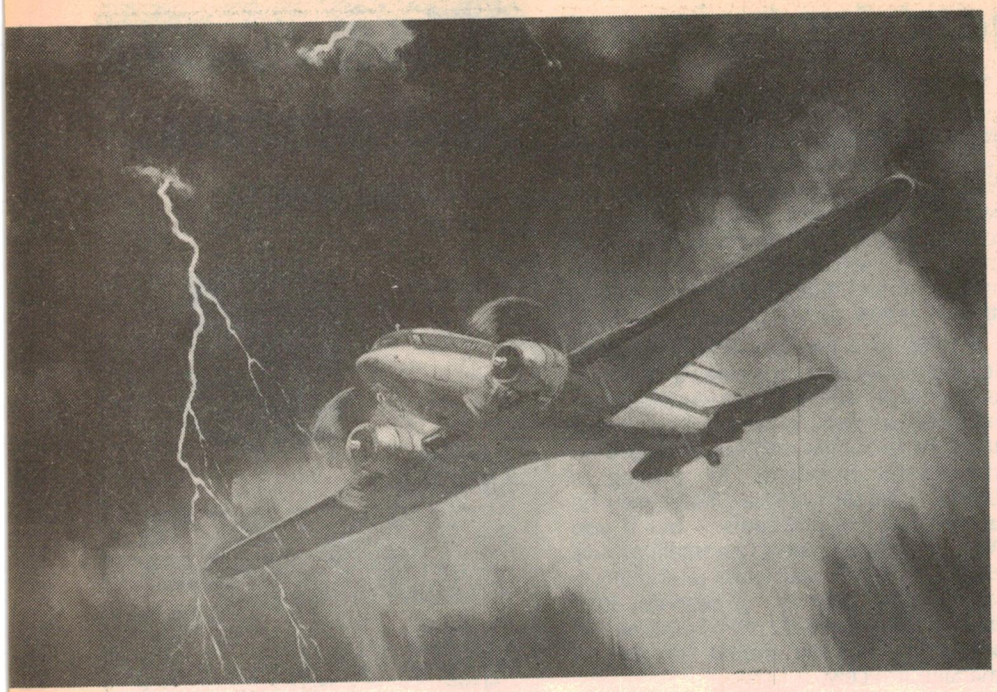


Lightning: its effect on aircraft

The latest glass-fibre and carbon-fibre composite materials now being used in the aircraft industry do not offer as much protection against lightning strikes as the aluminium alloy used previously. Scientists at the United Kingdom Atomic Energy Authority (UKAEA) laboratory at Culham, England, have been working on the problem.

by PHILIP LITTLE

Enquiries about high current tests simulating the effects of lightning strikes were first made at Culham by UK aircraft manufacturers in 1970. Some work was done with limited equipment capable of providing the simple test current pulses then required. These early studies included tests on a Westland helicopter, on the European Airbus and on Concorde.

At about the same time the Ministry of Aviation Supply (now the Ministry of Defence) requested feasibility studies from Culham and another UK laboratory on the effects of lightning strikes to aircraft and means of simulating these effects in the laboratory. As a result, a contract was placed with Culham to build a facility for lightning testing, to undertake a program of applied research and to act as an advice centre for the UK aerospace industry. In this way the Culham Lightning Studies Unit (CLSU) was established in 1972, with support from the Ministry of Defence and the Civil Aviation Authority.

The Unit is now internationally recognised for its expertise in lightning protection for aircraft. Its staff consists of five professional engineers and scientists, with appropriate technical and general support to make up a team of nine full-time members, sometimes supplemented by other Culham staff. Superb lightning simulation facilities have been constructed to test aircraft and aircraft components by passing current pulses representative of severe lightning strokes through them in a realistic manner.

Aircraft of course are a very safe form of transport, and usually if lightning strikes an aircraft negligible damage results. The average aircraft is struck about once a year. A few burn marks and a slight pitting of the skin are normally the only lasting consequences, though the strike itself may be a very startling event.

Sometimes more severe structural damage occurs, and obviously strikes to the fuel vents or fuel jettison pipes are particularly hazardous. Electrical and electronic systems are also very susceptible to damage by lightning.

Modern aircraft rely on complex electronic systems, including computers, for communication, navigation and other essential functions. The actual flight control of future aircraft may be performed through electronic systems guided by an on-board computer, so interference with such equipment must be avoided.

The problems of protecting aircraft against lightning have become more difficult with the introduction of new materials which replace the aluminium alloy previously used. A metal skin affords a degree of protection which glass-fibre or carbon-fibre composite materials fail to provide, and such materials are increasingly used in the aircraft industry — for excellent reasons. In order to understand the hazards, consider what happens when lightning strikes an aircraft.

Thunder and lightning

Fig. 1 shows the base of a thundercloud, a region of high potential where strong electric fields exist due to an electric charge (usually negative) produced in the cloud base. When the field is strong enough, breakdown occurs and a bright channel grows out of the cloud, advancing in steps towards the ground along a tortuous path that shows frequent branching. This is called a stepped leader.

Any aircraft close to the cloud will begin to produce electrical discharges from sharp extremities (nose, wing tip, rudder, etc) in the form of a glow or corona discharge and these also may grow into stepped leaders. If one of these meets a cloud leader the aircraft becomes part of the current channel.

The leader continues to grow toward ground, with the aircraft carrying the current pulses which flow as the leader advances. When the leader reaches the ground if forms a bridge between cloud

and ground, and a heavy current pulse flows back up the channel and through the aircraft. This is the first return stroke, typically carrying 30kA. It causes intense and rapid heating in the channel, which becomes very bright as the pulse passes, and expands rapidly. This expansion causes the thunder always associated with lightning.

Sometimes after a pause of a few hundredths of a second another, faster leader and another return stroke may appear, and this may be repeated several times. In a severe storm, up to thirty re-strikes have been recorded, though the average worldwide is about three. The peak current for re-strikes is typically 10kA. After the last return stroke a current of several hundred amperes continues to flow for a few tenths of a second, and occasionally this continuing current appears between earlier re-strikes. The whole event is called a lightning flash.

During the time of the strike, of course, the aircraft is moving, and this movement causes the attachment point of the lightning arc to move over the surface of the aircraft (Fig. 2).

Thus an arc which is initially attached at the nose will move backwards with respect to the aircraft, so that successive positions of the attachment point will be further aft. The rear attachment point cannot move backwards, but some extension of the channel does occur. The direction of air flow over the aircraft skin largely determines the motion of the arc attachment points.

The attachment point of the arc does not slide smoothly back along the skin of the aircraft, but moves in a series of steps, of variable length, which roughly follow the airflow across the surface. Instabilities in the arc may produce kinks and bends, so that later attachment points may not lie driectly behind the first point. If painted surfaces are involved the step length will be longer because the potential along one step must break down the insulation provided by the paint (Fig. 3).

At trailing edges where further movement of the attachment points is impossible the arc hangs on to the rearmost conductor available to it. The remaining current pulse flows into the same point, and here the most severe arc damage occurs. If an initial attachment occurs at a trailing edge or on the tail the whole stroke current flows into one point. The longest possible hang-on time is taken to be the time between re-strikes, for the rapid rise of current in a re-strike causes very large induced voltages along every section of the channel and any bends are likely to be short-circuited by breakdowns. The generally accepted figure for this maximum time is 50ms.

The surface of the aircraft can be divided into three zones on the basis of the behaviour of these attachment points. Initial attachments are said to occur in Zone 1 – this includes all the sharp extremities of the aircraft. Areas to which the attachment points may sweep are defined to be Zone 2 – these lie in the slip-stream behind the forward Zone 1 areas. The remaining surface areas, defined as Zone 3, are unlikely to experience direct attachments but may carry lightning currents between attachment points, so that in these regions also some effects of lightning may be seen.

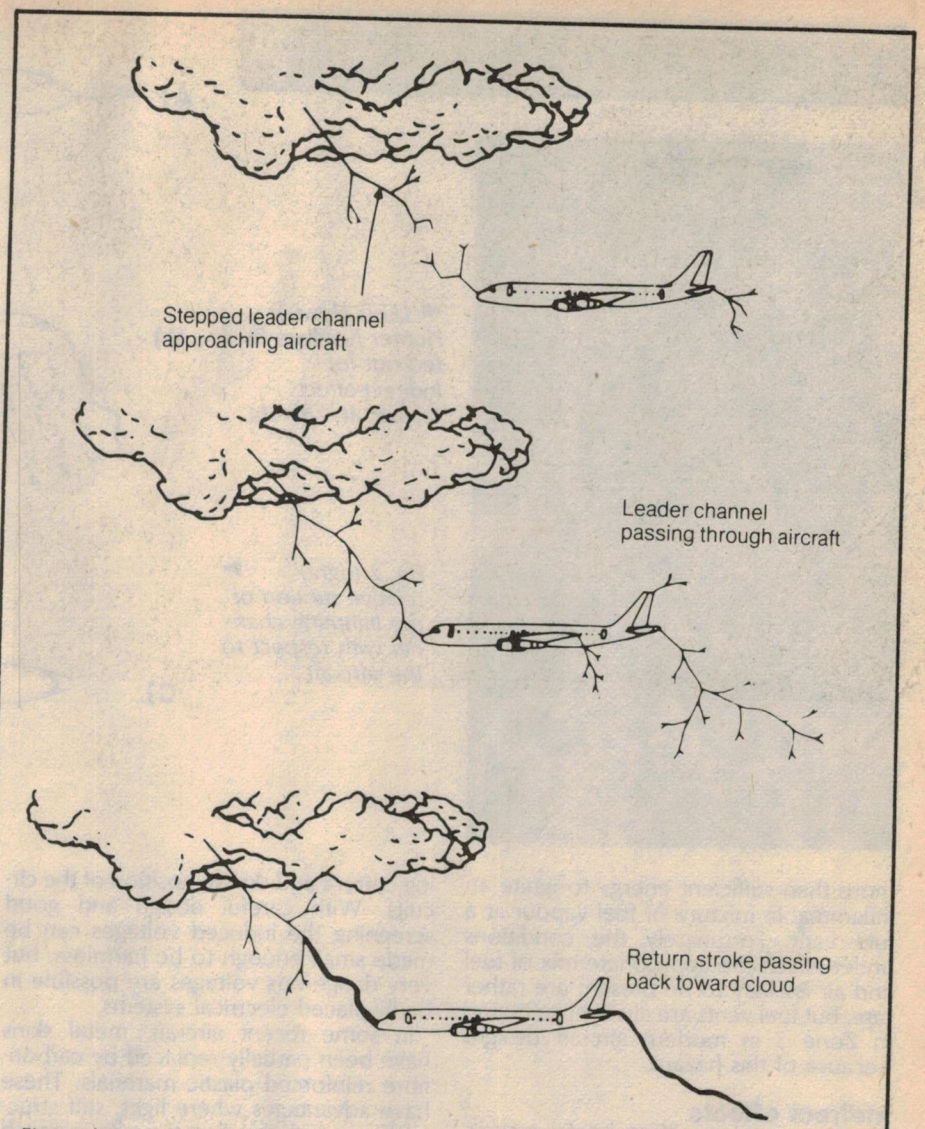


Fig. 1: how an aircraft becomes part of the lightning channel.

Fig. 4 shows one example of zoning on a typical aircraft.

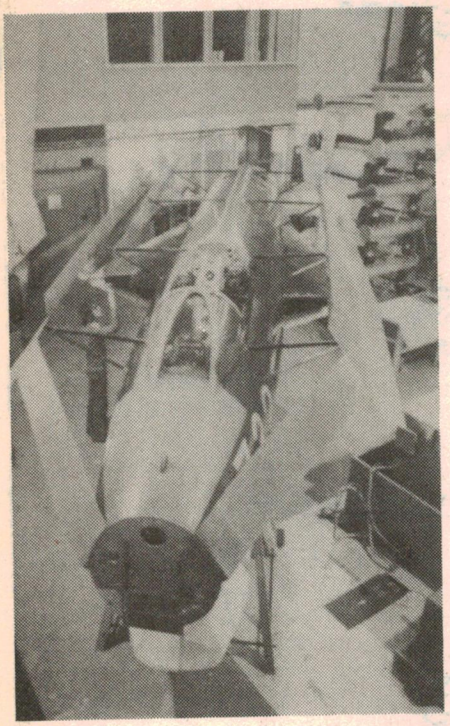
Every flash differs from every other flash, and statistics about the peak current, the rise time of the current pulse, the charge transferred and other parameters have been painstakingly gathered in many countries. Sometimes positive charge is lowered to ground, and very frequently discharges between clouds occur that never transfer charge to ground at all. Internationally-agreed standard current waveforms for testing aircraft and aircraft components have been developed on the basis of the characteristics of ground flashes, since these are considered to be the most severe.

Direct effects

A current pulse through a resistance dissipates energy, leading to heating effects and possible vaporisation. If enclosed conductors are vaporised, mechanical pressures can build up and split the container, as trees are split when the sap is vaporised. Mechanical shock waves from the heating effect and magnetic effects of the current pulse can also cause damage by distorting the aircraft structure.

The main risk of melting and puncture occurs after the initial stroke, at the tail of the peak current pulse which has an average amplitude of around 2kA. For currents of this level, the charge transfer determines the damage to the attachment point and is an important consideration where fuel tanks are placed immediately beneath the skin.

Any one of the components of a lightning strike, from the initial high current strike to a severe re-strike, could provide



◄ *LEFT: Hawker Hunter fuselage fitted out for indirect-effects testing at Culham.*

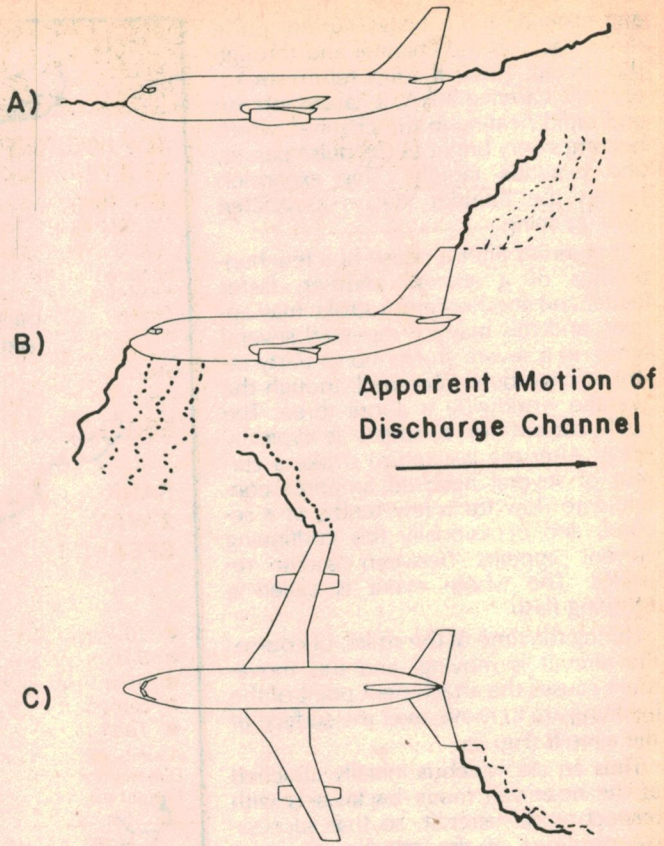


Fig. 2 (right): ► relative motion of the lightning channel with respect to the aircraft.

more than sufficient energy to ignite an inflammable mixture of fuel vapour at a fuel vent. Fortunately the conditions under which the appropriate mix of fuel and air is likely to be present are rather rare, but fuel vents are always positioned in Zone 3 in modern aircraft designs because of this hazard.

Indirect effects

Indirect effects of lightning are of two kinds. The first arises when the current pulse in a continuous metal conductor, such as a metal aircraft without windows or gaps of any kind in the skin. Fast-rising currents flow at first only on the outer surface, causing any direct damage immediately.

The current diffuses into the skin slowly, and a voltage pulse appears later on the inner surface. Its magnitude is determined by the skin thickness and conductivity, the shape of the aircraft, and the form of the current pulse. Such a voltage pulse is injected into electrical circuits connected to the inside of the aircraft skin as an indirect effect of lightning, but the voltage is small when metal skins are used.

Other indirect effects appear because the aircraft skin is not continuous: the changing magnetic field due to the lightning current can link directly with electrical systems within the aircraft. The field penetrates air gaps or apertures covered by electrical insulators such as glass, perspex or glass-fibre composite materials. Voltages are then induced in circuits which lie underneath any break in the metal skin; the size of the voltage depends on the rate of rise of the lightning current and on the position of the circuits. With careful design and good screening the induced voltages can be made small enough to be harmless, but very dangerous voltages are possible in badly-placed electrical systems.

In some recent aircraft, metal skins have been partially replaced by carbon-fibre reinforced plastic materials. These have advantages where light, stiff structures are needed but they have much greater (x1000) electrical resistance than metals. The direct damage done in carbon-fibre composites when a lightning current pulse flows is likely to be much greater than in metals because the energy dissipated is proportional to the resistance. Damage at an arc attachment point is also more severe. Neither type of direct damage appears with glass-fibre composites, for these are genuine electrical insulators.

Indirect effects in circuits underneath panels of cabon-fibre composites may be nearly as great as if the panels were absent, or made of glass-fibre composites. The penetration of the magnetic field is nearly as fast as through an open aperture. Very high voltages appear across a carbon-fibre panel momentarily, but the current soon moves into neighbouring metal if a parallel path can be found. Voltages inside an aircraft made entirely of carbon-fibre composite would be much higher than those inside metal aircraft. Great care must be taken in the protection of electrical equipment and wiring when composites are used, especially if digital electrical systems are involved.

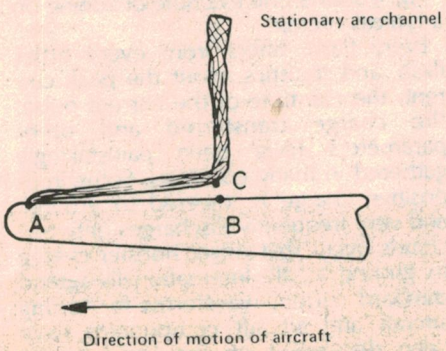


Fig. 3: attachment point formation.

Lightning in the lab

It is impossible to describe in detail here how the test current waveforms are produced in the laboratory. In the CLSU facility 20kV and 100kV high-voltage capacitor banks supply current either directly to the load or to an intermediate inductive energy store for direct effects testing. An inductive store acts as a current source, providing a current pulse almost independent of the load impedance in the same way as a lightning stroke does.

Other new techniques in lightning simulation and testing developed by CLSU include a multiple current feed to an arc. The inner conductors of six coaxial cables are extended to surround a central arc – current flows up these conductors and down the centre lead to the arc. The base plate holds the specimen and the current returns to the source via the outer screens of the coaxial cables. The whole system is balanced so that equal currents flow in each cable and no

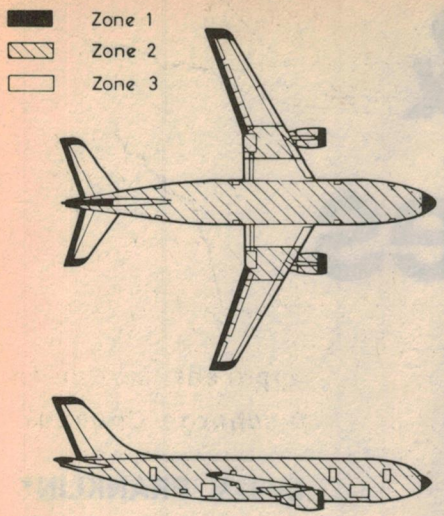


Fig. 4: typical aircraft lightning zones. Initial attachments occur in Zone 1, may transfer to Zone 2. Zone 3 is unlikely to experience direct attachments.

net magnetic field exists at the arc. If such precautions are not taken the arc is moved by the residual magnetic field due to the current leads and unrepresentative damage results.

For indirect effects testing, a low-inductance 1MV capacitor bank is used in the CLSU facility. This type of generator is needed to produce the high rates of rise of current required, and the load circuit must also be of low inductance. In addition, the current distribution around the aircraft studied must be the same as if that aircraft were remote from all other bodies if a good simulation of a lightning stroke is to be obtained. If a single wide metal strip is used as the return conductor for a current pulse along the fuselage, the magnetic field around the fuselage is stronger near the return conductor than elsewhere. Using three symmetrically disposed return conductors, a much more realistic field distribution is computed and this is confirmed by experiments.

To measure the voltages induced in cables and in small coils responding to magnetic field changes elaborate precautions against interference from spark gaps, open arcs, etc, must be taken. The diagnostic circuits must be carefully placed to eliminate the risk of voltage breakdown to the sensitive measuring equipment. The output signals are displayed on oscilloscopes and photographed, or fed into a transient digitiser for further analysis.

This data analysis system is expected to become more important in the future, as the high frequency behaviour of electonic equipment in aircraft struck by lightning becomes more important.

This article originally appeared in "Atom" (monthly information bulletin of the UKAEA), and is reproduced here in slightly condensed form.

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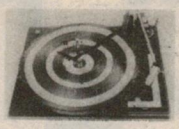

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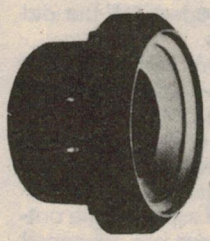

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Solar power & space satellites

Most spacecraft use arrays of solar cells to generate electrical power, but developments in space often point the way to more down-to-Earth applications. In this article, a British expert discusses some of the criteria involved in the design of solar arrays, and examines the proposal for an orbiting solar collector which would use microwaves to beam electrical energy to the surface of the Earth.

by I. V. FRANKLIN*

The provision of electrical power is of fundamental importance to every spacecraft regardless of its size, mission or complexity, and with very few exceptions all spacecraft use solar arrays for primary power generation.

The first solar array to power a spacecraft was used on Vanguard, launched by the United States in November, 1958. It generated a modest 1W but did so reliably for six years.

Solar arrays are favoured for spacecraft because they are lightweight, reasonably simple, passive devices using a free, virtually non-depletable energy source – the Sun. The basic technology is well understood and is the subject of continuing improvements in all aspects. The output power of solar arrays has advanced from small beginnings to the multi-kilowatt systems now under development in both the US and Europe.

The large increase in power is a consequence of the forthcoming availability of two new large capacity launch and transportation systems. These are the Ariane expendable rocket being developed by the European Space Agency (ESA) and the Shuttle Orbiter combination being developed by NASA. As satellites become larger, their power requirements will increase, leading to the very large solar arrays forseen for the future.

Britain's interest in solar arrays began in 1963 with the development of the all British Ariel 3 satellite, which was launched in May, 1967 and whose array generated above 10W. Since that time, British solar arrays have been built for the X-3, X-4, Ariel 4 and Ariel 5 spacecraft. In the international market, British Aerospace has provided solar arrays for 16 of the highly successful Intelsat 4 series of communications satellites and the COS-B scientific satellite for ESA.

The Intelsat 4 arrays generate some 540W and were the largest arrays made outside the United States.

Work is proceeding on the design and development of the solar array for the NASA Space Telescope on behalf of ESA. Activities are also taking place at British Aerospace on developing the technology necessary to achieve a 10kW lightweight solar array suitable for use on advanced communications satellites.

*Senior Projects Manager, British Aerospace Dynamics, Filton House, Filton, Bristol, Avon, England.

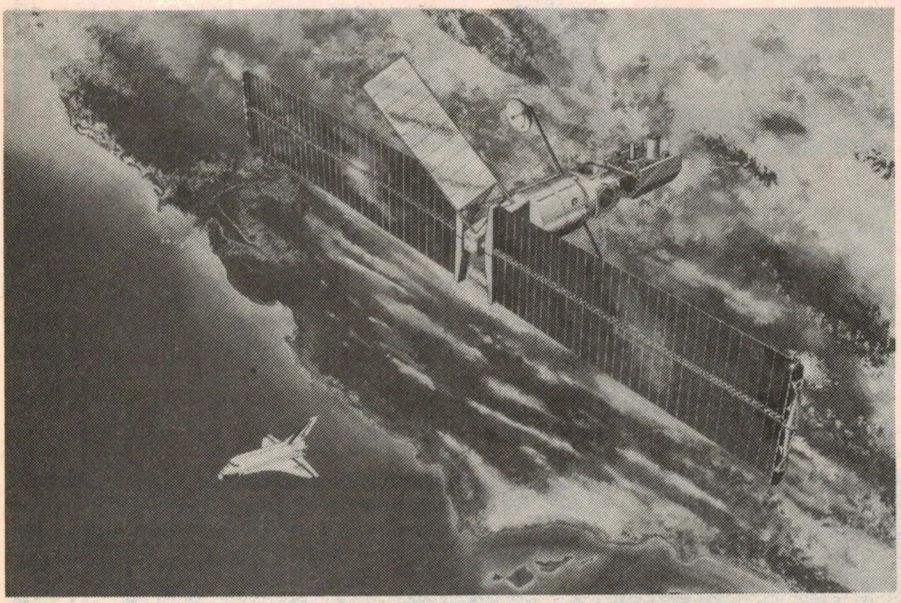


Fig. 1: artist's concept of a 25kW solar power module that could be used to extend Shuttle missions. Lockheed Missiles & Space Company is evaluating the concept.

Deployable solar arrays

With the exception of simple spinning satellites which always have body mounted arrays on rigid substrates (Fig. 2) solar arrays are usually mounted on structures that can be deployed from the spacecraft body side. The basic types of deployable solar arrays are:

- Hinged rigid panels which fold out to form the array, using springs or wires (Fig. 3).
- Flexible solar arrays which either roll out from a drum or fold out from a box under the action of telescopic or otherwise extendible booms (Fig. 4 and Fig 5.)

There can be combinations of these basic types to meet particular mission requirements. For example the Lightweight Hybrid Solar Array (Fig. 4) being developed by British Aerospace has a rigid array panel to provide spacecraft power during the transfer orbit when the spacecraft is still spinning for stability. The main array, which is flexible and folded, is deployed when the spacecraft is positioned and stabilised in a geostationary orbit.

The most interesting current development is the array being built by British Aerospace for the NASA Space Telescope. This array, which will be the largest built outside the United States, has a double roll out configuration, with

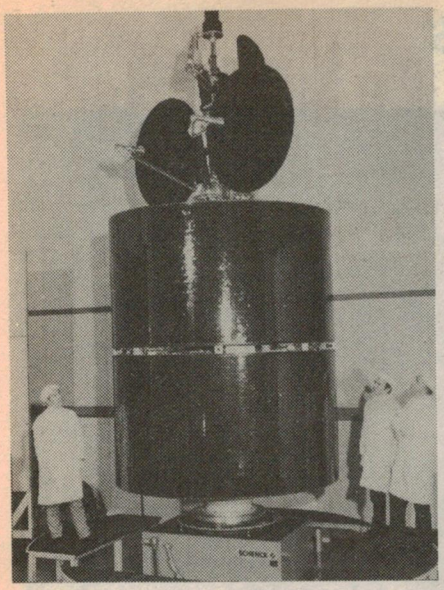


Fig. 2 (left): the Intelsat 4 satellite has a body mounted solar array. British Aerospace has built the array for 16 of these craft.

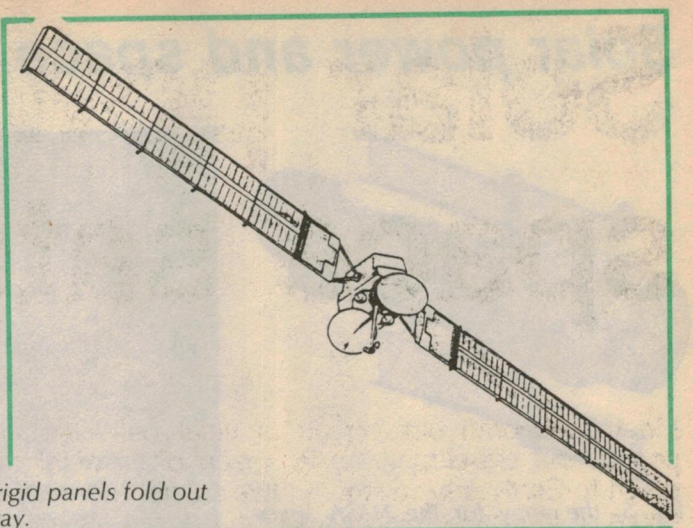


Fig. 3 (right): hinged rigid panels fold out to form this solar array.

two solar array blankets that roll off a common central drum as shown in Fig. 5. This array will generate more than 6kW at the beginning of its life, and will have a retraction capability and facilities for astronaut in-orbit maintenance and contingency operation.

Design requirements

The principal features of the space environment that influence solar array design are solar radiation, space vacuum, electron and proton radiation, and orbit and temperature excursions.

The Sun may be considered as an enormous thermonuclear reactor radiating energy, and thus is the most natural energy source for a spacecraft. The average value of radiation received at one Astronomical Unit, which is equal to the distance between the Sun and the Earth, is approximately 1400 W/m^2 and is referred to as one solar constant. Solar activities can cause a variation of this value by about ±1%.

The hard vacuum of space places stringent requirements on materials and mechanisms, particularly on non-metallics and lubrication systems. Main material problems concern the maintenance of dimensional stability and prevention of outgassing.

Belts of radiation exist in space that can be harmful to spacecraft and their subsystems. Continuous bombardment of silicon solar cells by electrons and protons is particularly damaging, causing significant reduction of performance and effective lifetime.

When electrons with an energy greater than 145keV and protons at energies greater than 98eV bombard silicon they can cause the displacement of an atom from its crystal lattice location. The various resulting defects may act as recombination centres for the charge carrier, reducing the diffusion length and thus lowering the collection and conversion efficiency. It is important, therefore, that the solar cell should be protected from this fundamental damage. This is done by attaching a thin 50um borosilicate glass cover slide to the front face of the cell.

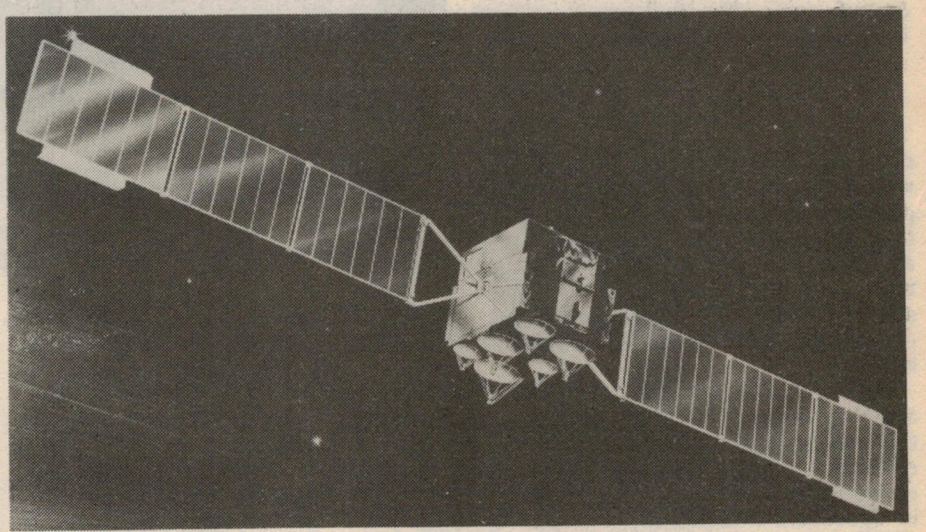


Fig. 4: this lightweight array has a rigid panel to provide spacecraft power during the transfer orbit when the craft is still spinning for stability.

Orbit implications are also very important because they influence the time the spacecraft spends in sunlight, the spacecraft eclipse periods (with consequent large temperature excursions), and the proton/electron degradation process. Typically, in a low Earth orbit – say 500km at an inclination to the Earth's equator of 80% – the orbit period is about 96 minutes. This produces a temperature excursion on the solar array of about +50°C to −100°C every 96 minutes, causing severe thermal stress.

Spacecraft attitude is important because ideally the Sun should be perpendicular to the solar array. If it is not, there will be a power loss proportional to the cosine of the solar aspect angle.

At geostationary orbit – 36,000km above the Earth's equator – conditions are rather better because the radiation damage is very much less, the eclipse times and frequencies are very much shorter, and the thermal environment is more stable. Typically, the eclipse periods occur twice a year at the solstices and last up to 72 minutes with a temperature excursion of +60°C to −170°C. However, it should be noted that this temperature change takes place over a few seconds and therefore produces a very severe thermal shock. The very low temperature, together with space vacuum, provides severe mechanical design problems for moving parts and lubrication.

Performance Parameters

The main parameters that govern solar cell and hence array performance are incident solar radiation, spectral response of the solar cell, cell temperature, conversion efficiency, and radiation damage due to electron/proton bombardment.

Solar cell temperature influences the power outputs and typical values are a voltage reduction of 2.5mV/°C and a power reduction of 0.5%/°C. At 300°C the output is zero. This efficiency reduction is important when it is considered that even a so called high efficiency cell has an efficiency of only 15%.

In addition to monocrystalline silicon

Solar power and space satellites

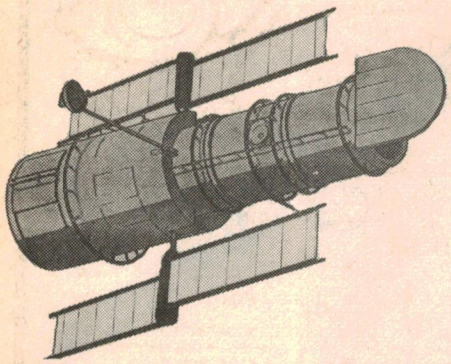


Fig. 5: the array for the NASA space telescope has two "blankets" rolling off a central drum. The British-built system will generate more than 6kW.

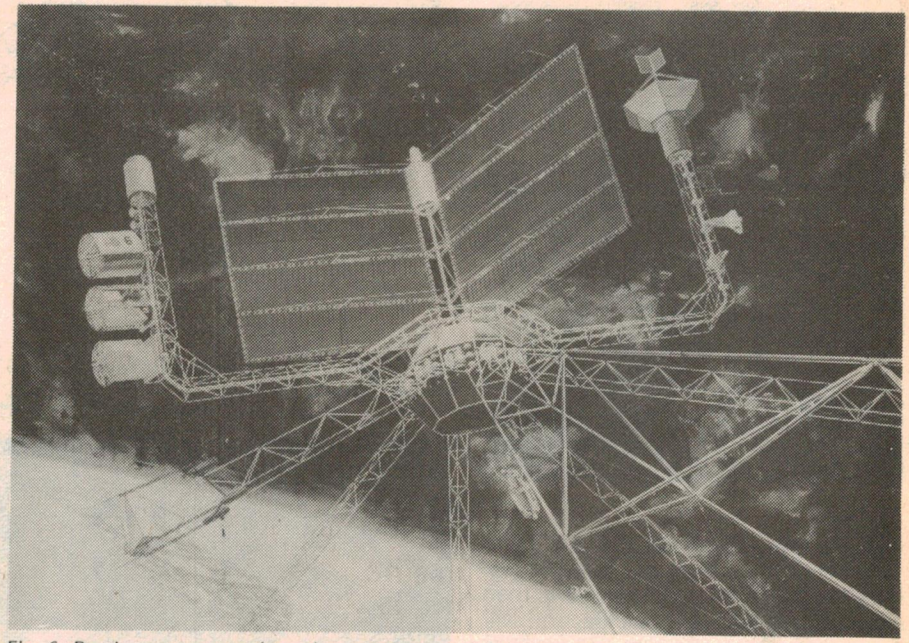


Fig. 6: Boeing concept of a solar power satellite being assembled in orbit. The spidery legs would support a huge array of mirrors serving as a solar concentrator.

cell material, development is proceeding with other forms of silicon, including polycrystalline, amorphous, and continuous ribbon. These developments are aimed at producing larger active areas than are possible with monocrystalline silicon. However, at present the efficiencies of the newer forms are somewhat low.

Another material is gallium aluminium arsenide, which has a higher efficiency than silicon and a better temperature coefficient, and is thus suited for use in concentrator systems where the sunlight is effectively doubled by the use of trough mirrors. This has the desirable effect of reducing the array area by about 50%. At present this material is scarce and expensive, but it may well come into prominence if the concept of a solar power satellite gains acceptance.

Solar Power Satellite

An increasing awareness of the growing world energy shortage has led many nations to consider the harnessing of additional energy sources to meet their future needs. The Sun's radiation in space provides a free and non-depletable source of energy, and it is against this simple idea that the concept of a Solar Power Satellite (SPS) has evolved over the last 10 years. The SPS was originally proposed by Dr P. Glaser in 1968 but attracted only limited technical interest at the time.

However, in 1973, when the realities of the oil situation became known and the implications understood, a great deal of effort was applied by the United States aerospace industry, supported by NASA, to undertake thorough technical and economic studies to establish the concept's feasibility and viability.

The concept is based on the photovoltaic conversion of solar energy into direct current electric power, which is collected and converted into microwave energy at high efficiency. This microwave energy is transmitted to Earth as a focused beam to a receiving station where it is reconverted to electrical energy for use in the national primary distribution network.

The concept comprises a lauch and space transportation system, a space segment in geostationary orbit, and a ground receiving and distribution system. The principal parts of the space segment are the solar array, including the structure and mechanisms, and the microwave generation and transmission system.

The array is the same in principle to those designed for conventional spacecraft, except of course for the enormous size of the SPS. The required orbit is geostationary, which places it at 36,000km above the Earth's equator and gives a constant line of sight with a ground receiving station in any area up to 60° north or south of the equator. The array would be illuminated by the Sun for more than 99% of the time and would thus generate electrical power almost continuously. It would be eclipsed at the time of the equinoxes for a maximum of 72 minutes around midnight, which is insignificant from the user standpoint.

The SPS has a planar array of solar cells measuring 10.5 x 5.2km, with a transmitting antenna 1km in diameter at one end for transmitting the microwave energy to Earth at 2.45GHz. The ground receiving-rectifying antenna – known as the rectenna – is contained by an eclipse measuring 10 x 13km which converts the microwave energy to electrical energy.

Two options have been specified for the solar array. The conventional silicon option requires an actual area of 52km^2 on a planar array. The second option suggests the use of gallium aluminium arsenide cells in conjunction with concentrator mirrors arranged in trough configuration. In this case the solar array area is reduced to 27km^2 with a reflector area of 53km.

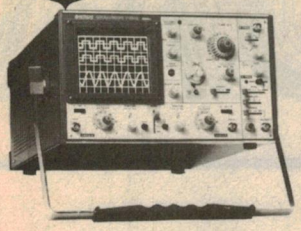
Approximately 10 x 10^9 silicon solar cells, measuring 65 x 75mm, are required for each SPS, or half that number of gallium arsenide cells.

Both of these quantities pose a formidable production problem. The planned lifetime of the array is 30 years and it therefore is necessary to consider methods of renewing the cells after a given degradation level. Silicon cells can be regenerated by laser annealing at 500°C every three to five years, while gallium arsenide is self-annealing.

The present status of the SPS in the United States is that it is the subject of an intensive study of concept development and evaluation by the Department of Energy and NASA, with the support of industry. By mid-1980, the Department of Energy was required to report on the possible acceptance of the SPS from all standpoints – environmental, technical, legal and economic – and to recommend future actions.

There are many problems to be solved but it is stressed that, unlike nuclear fusion, no fundamental technology breakthroughs are required for the SPS to be considered as a serious candidate for energy supply. One of the practical problems is that of environmental and public acceptance, and much work is needed in this vital and sensitive area.

HITACHI OSCILLOSCOPES



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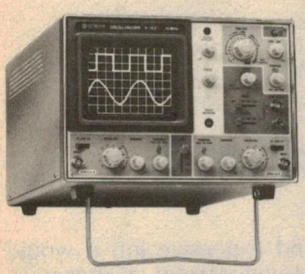

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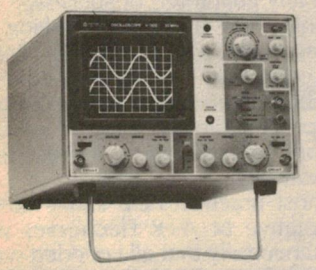

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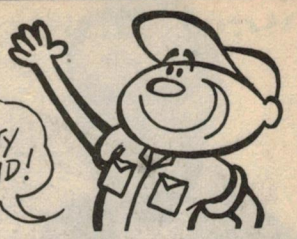

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FORUM

Conducted by Neville Williams

Environment is the "in" thing — For everything except the radio spectrum!

As I drive into my domestic garage, each evening, I don't need to be told that the lights are on in the lounge/dining area. In the car radio, I can hear the electrical hash generated by the switch-cum-dimmers. At one time, they were much worse than they are now, virtually wiping out the weaker stations altogether!

I faced the same problems with a portable radio, during the evening, or the tuner in the hifi system. FM and TV signals were not affected, nor even the shorter short-wave stations. There was just this broad blanket of noise from below the broadcast band to 3 or 4MHz, confined substantially to the perimeter of the building.

Dimmers were installed when I took over the house, some time ago, and they've been retained because of their obvious convenience. If we want bright light for reading, we can have it; if we want subdued light for eating, or less still for watching television, we can have that, too.

It's largely for this reason that solid-state dimmers have proved so popular in Australian homes – plus the fact that they are available cheaply and readily, and able to be fitted in place of the usual architrave switch.

But, what worries me is the amount of RF interference they can create, virtually irrespective of the brightness setting. It happens because the in-built Triacs switch from "off" to "on" at some point during each mains half-cycle, with a wavefront so steep that it creates a profusion of harmonics extending well up into the radio spectrum. Indeed, Triacs rely on abrupt switching to minimise internal dissipation and heat rise.

As producers of broadband noise, they probably do a better job than the old-fashioned multivibrators that we once used on the test bench to align the trimmers and padders on dual-wave receivers. With Triac-controlled lighting, we'd never have needed them!

In discussing the matter with neighbours and friends, I would judge that my problem was – and still is – greater than most. But the average hash level seems only to be marginally below the signal laid down by local AM stations, and it really takes over in the gaps between them.

Who said anything about DX listening? For my own situation, I can see two possible aggravating factors:

One is a continuous layer of aluminium foil under the titles, apparently earthed. It possibly has the effect of attenuating the level of radio signals inside the house. It may even tend to concentrate the interference field – inadvertently repeating in the radio spectrum its role as a reflector of ordinary heat.

The second factor is a mass of wiring in the ceiling space, feeding a generous number of internal and external lights, plus an array of power points. Hash in that lot would really be sprayed around!

Early on, I considered the idea of relocating most of it under-floor but what a messy and expensive job it would be, without any guarantee of success.

Certainly, less ambitious fiddling offered no worthwhile reward. Mains bypass capacitors and series toroids of practicable dimensions in accessable places proved largely a waste of time and effort – despite various predictions to the contrary.

The most practical help came from a representative of A+R Electronics who insisted cheerfully that all I needed was a couple of decent hash-free dimmers – like their ARLEC brand . . . this with all due modesty.

They were available in a bubble pack from variety, electrical and hardware stores for something under $10. If I wanted further information, I could contact the company's head office at 30 Lexton Rd, Box Hill, Victoria. Phone 03 89 0661. ("Funny you should mention it but I have one in my folio, right here!")

Sufficient to say that, when I did get to try one of the ARLEC LD500 dimmers, it proved to be much quieter than the other types which had been installed. It certainly isn't perfect but hash can be discerned only on the weaker locals and the inter-station roar has diminished to a buzz.

But that's in suburban Sydney, within a few kilometres of the broadcast stations. I imagine that it would be a very different story in outer Bandywallop!

What worries me is that we are busily surrounding ourselves with sundry solid-state controllers of light, heat and speed – approved by the authorities but, by their very nature, prone to the generation of radio frequency hash.

We build into the controllers only that amount of radio frequency suppression that can be accommodated within the constraints of convenient size and competitive price. The electrical environment is very much the loser – probably because electrical pollution is not apparent to our native senses.

As you might imagine, there had to be something to prompt this oration. It was a letter from B. H. of Heathmont, Vic-

The Australian-designed Arlec domestic light dimmer is one of the better ones on the market. In terms of radio frequency interference, some of the others in common use are awful!

toria and the relevant portions read essentially thus:

Dear Sir,

I was most interested in Peter Vernon's description of a hand-held hair dryer in the July 1980 issue . . . etc.

It happens that, two weeks ago, during a discussion with her hairdresser, my wife was informed that she was using the wrong type of dryer for her hair style and a new, more appropriate, model was suggested . . . and purchased.

The following Saturday, I was in the garage listening to some music on 3AR when, all of a sudden, the most atrocious noise came over the radio, completely blanketing the transmission. Thinking that something had gone wrong with the set, I went inside to get my multimeter, only to be greeted with the same noise from another set in the kitchen, tuned to 3AW.

Then, through the background, I could hear the high-speed whine of the new hair dryer, and I twigged where the noise was coming from.

It turns out that this is a "new breed" hair dryer, where the latest in solid-state electronics is used to control the fan speed and the output from the heater element. By simply rotating a potentiometer, you control both – the ultimate in user simplicity and the ultimate in the generation of radio frequency interference!

Perhaps my experience will provide Peter Vernon with the basis of a follow-up article: "Inside a new hand-held dryer". In so doing, I hope that he may be able to suggest how suppression components might be added to eliminate RFI.

In the meantime, I have wired a .01/1000V capacitor across the power cord connections inside the handle and this gave a worthwhile reduction, without being anything like a complete solution. I am now considering cutting off the existing power plug and replacing it with a type that can house a larger bypass inside the plug body. Hopefully it will prevent a bit more of the RFI from getting back into the mains.

B. H. (Heathmont, Vic)

The problem outlined by B. H. is essentially the same as that posed by the light dimmers, but with the advantage that he has a little more scope and room for ingenuity with a portable appliance, even to the provision of a separate line filter.

In fact, it reminds me of a similar problem I encountered some years ago with an admittedly non solid-state sewing machine controller. I looped the power cord two or three times through a large ferrite toroid. It proved to be the cheapest and simplest line filter ever but whether it would have coped with solid-state transients would be another matter.

But the point behind B. H.'s letter is plain enough: a new model hair dryer is

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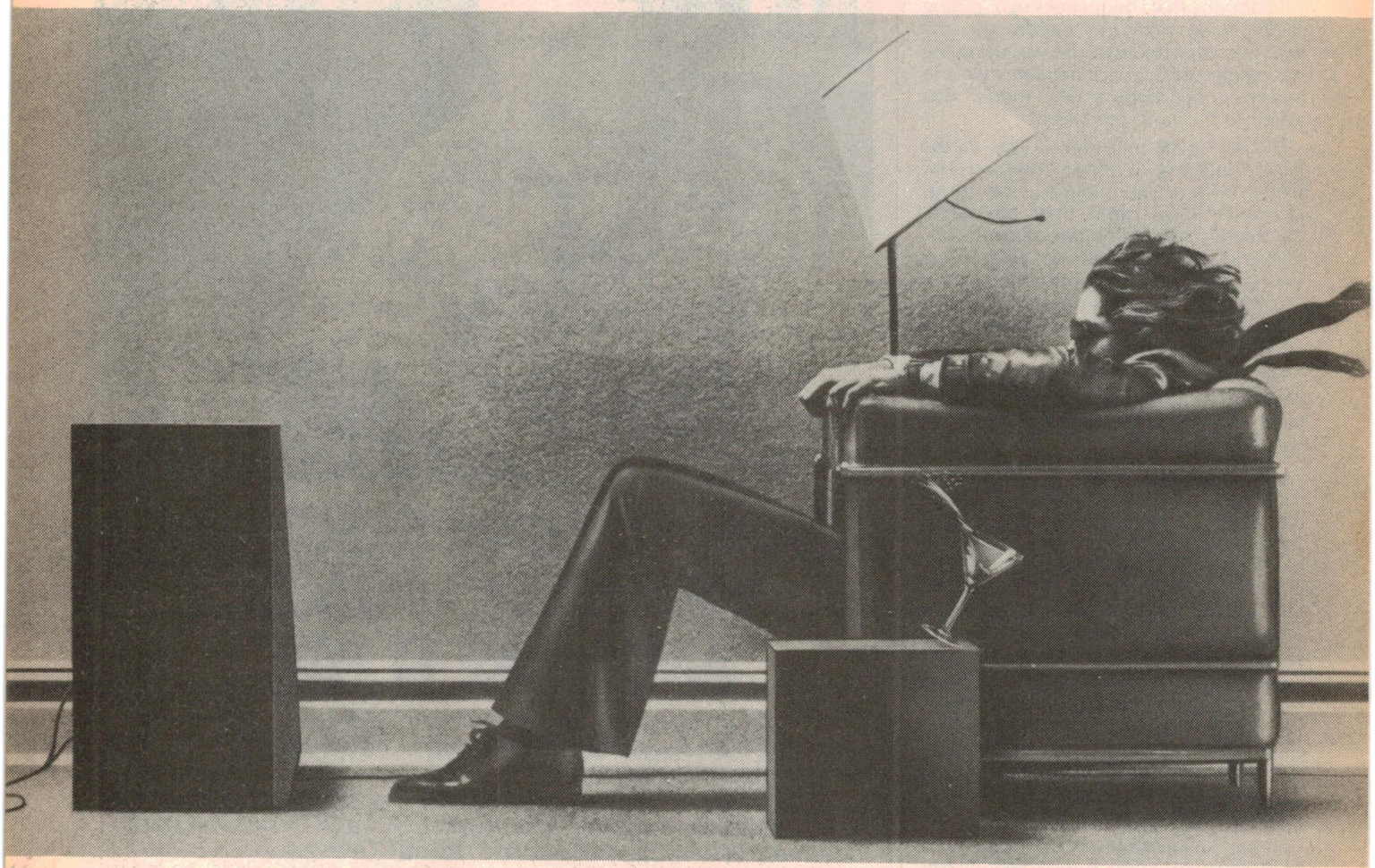

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on sale in the shops, using modern technology and presumably okayed by the electricity authorities – but capable of spreading radio frequency interference like a disease.

It's not good enough! I – we – the community have a far too relaxed attitude to electrical pollution. The whole situation is on the (electronic) nose!

And while we're enjoying a good old Australian whinge, what about those street lights that one encounters along major roads, in New South Wales, at least. Every odd one here and there is laying down a pool of interference audible on the car radio over a radius of about 50 metres.

Oh yes, and the NSW Government diesel buses which radiate a high frequency buzzing noise, rather like a synthesiser gone mad!

Behind all this lies the familiar environmental scenario.

We breathe fumes, inhale particles, ingest substances, contact chemicals and modify our external environment in various ways until the particular practice is questioned.

Debate follows, given momentum by a whole string of sectional interests – philosophical, academic, political, commercial and so on.

WHAT OF THE LAW?

But what does the law say? Perhaps it is being ignored. What it says may be vague or irrelevant or out of date. Maybe it says nothing at all!

At that point, it becomes the responsibility of the relevant government to enact appropriate legislation – a very unpopular pastime when the subject is highly contentious. Much better to make accommodating noises, but to sweep the whole thing under the parliamentary rug.

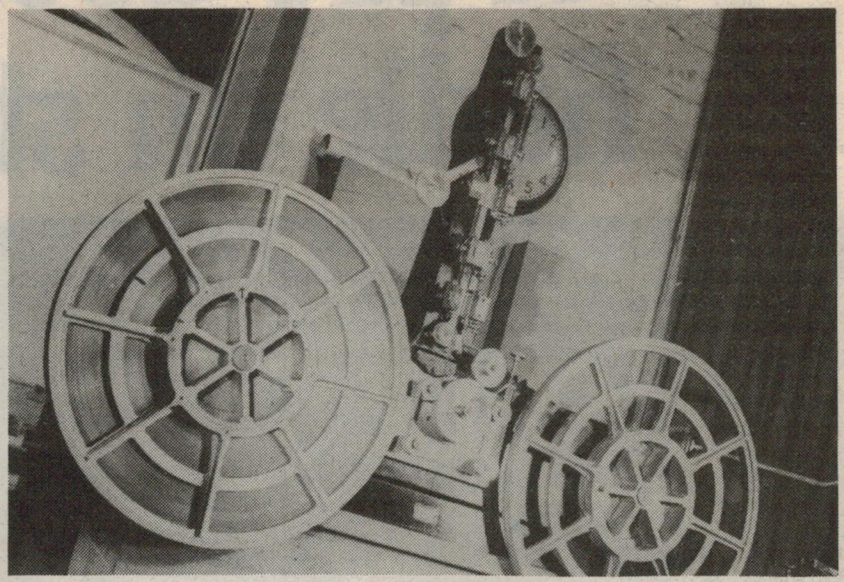
And that's where the matter of electrical/electronic pollution rests at the moment: as an untidy lump beneath the carpet in Federal Parliament. In fact, spectrum pollution, by its nature, is part of a larger lump to do with spectrum management – a lump which may broadly be identified as the Wireless Telegraphy Act for the '80s . . . '90s?

It's been there for so long that generations of politicians have grown used to walking around it. It may well have to be provided with a special under-carpet repository in the proposed new building.

But, until the whole thing is taken out, dusted off, re-framed and re-enacted, spectrum pollution will continue to float upwards – through restraints that lack the force of law.

In the meantime, we are in a "chasing our tail" situation. We accept repeated increments in the interference ambient because it would be uneconomic to do otherwise. That ultimately makes it necessary to grant periodic increments in transmitter power which then, of course, can accommodate a higher hash level. . . .

The Marconi-Stille tape recorder



Dear Mr Williams,

I was interested to read the letter in your January issue from V.T. regarding the Marconi Stille Tape Recorder. It prompted me to look through my old photo negatives for a picture of a similar machine (print enclosed) which I operated at the Melbourne Studios of the ABC during the years from 1937 to some time in the early '40s.

Ours must have been an earlier model, I think, as I am sure that it did not produce figures as quoted by your correspondent. The signal/noise ratio was not all that could be desired, mainly due to the fact that it used DC bias and erase. The tape speed as I recall, was 18"/sec and a spool ran for 30 minutes. Driving power was 3 motors of ⅓rd hp each. One drove the capstan; the other two each drove one of the spools, via a slipping clutch, the friction material being a disc of felt of about seven inches in diameter.

Tape drive was quite positive: the tape was clamped to the capstan, a brass wheel of about five inches in diameter, over 180° of its periphery by an endless woven canvas belt, which ran over four ball-bearing pulleys, three fixed and one adjustable by which the belt was tensioned.

From the supply spool on the left, the tape ran under a spring loaded jockey pulley, thence to the top of the head column and down through the heads, one erase, two record and two replay with change-over switches. The heads could be opened whilst the tape was running – the second record and replay heads are shown open in the picture – so that pole pieces could be changed without interruption to the program – sometimes necessary due to wear or deformation caused by bad tape joins.

Joining the tape was quite a job – no quick splices. The broken ends were skived off to zero thickness over about ¾" by means of an emery stick over a round metal block, and the two tapered ends sweated together with soft solder, the idea being to produce a join such that there was no increase in thickness over the join. We didn't often get it that good!

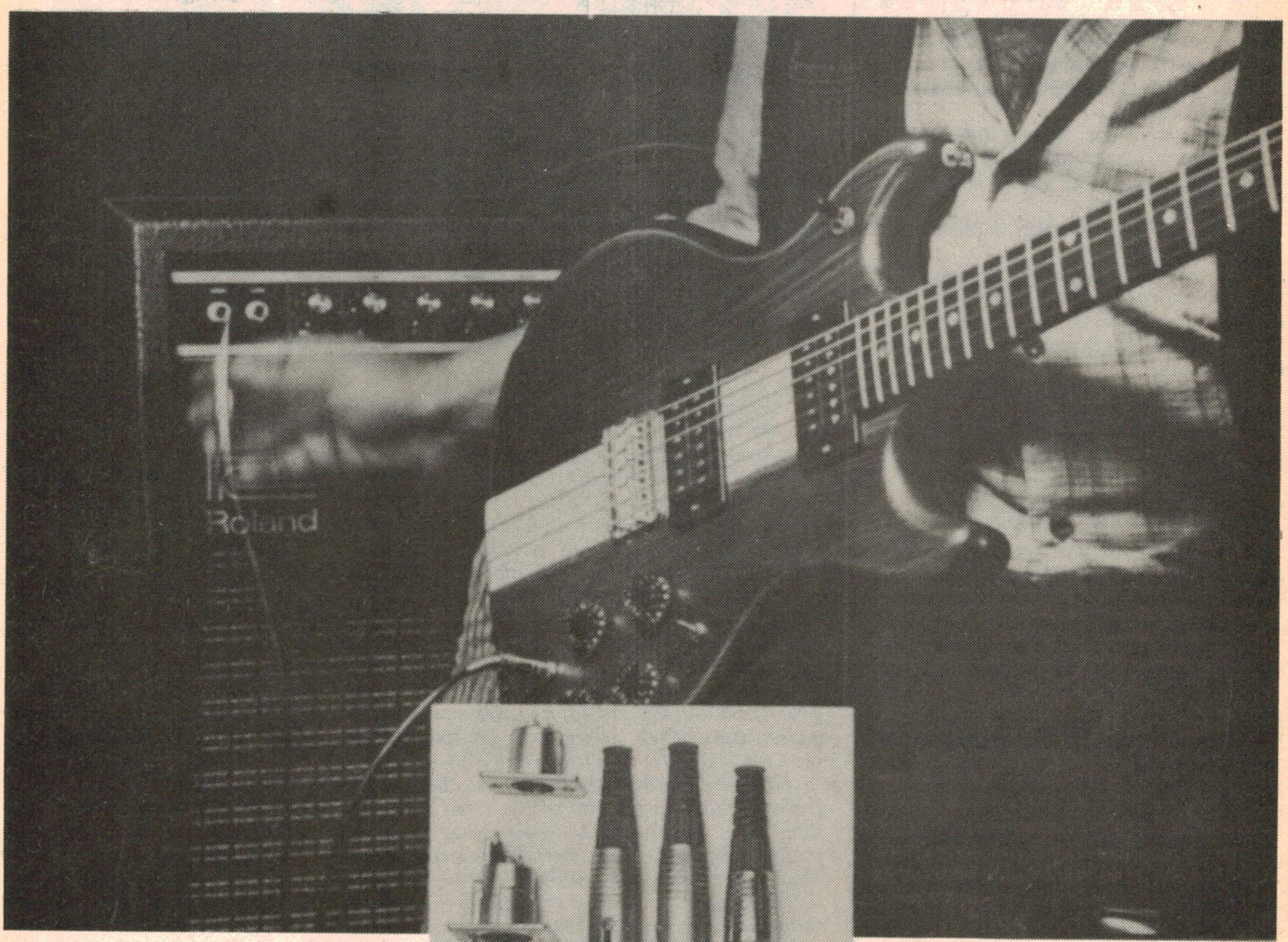
The machine had no fast rewind, it took 30 minutes to rewind, the same as to record or play. As we only had one machine, recording performances over 30 minutes in length was a problem. In this case we off-loaded the full take-up spool, replaced it with the now empty supply spool, and replaced this with a new full one. Whilst one operator did this, another covered the gap by recording on a 12" disc at 78rpm. This was all right on recording; if the 3-minute disc wasn't enough, use another until the tape machine was ready to carry on. But, on replay; the tape change-over had to be done within the duration of the disc.

The recorder was not considered good enough for high quality music, and was used mainly for speech program, especially such things as the routine recording of the midday news analyses etc for subsequent replay in the evening, as well as the multitude of items from overseas during those years.

One I particularly remember – I still have a disc copy – was the famous – or infamous – description by a tipsy BBC commentator of the review of the Fleet at Spithead. "The Fleet's Lit Up". We nearly wore the machine out that day replaying it to any one who called.

SP Coath (West Preston, Vic)

A pro doesn't fiddle on stage.



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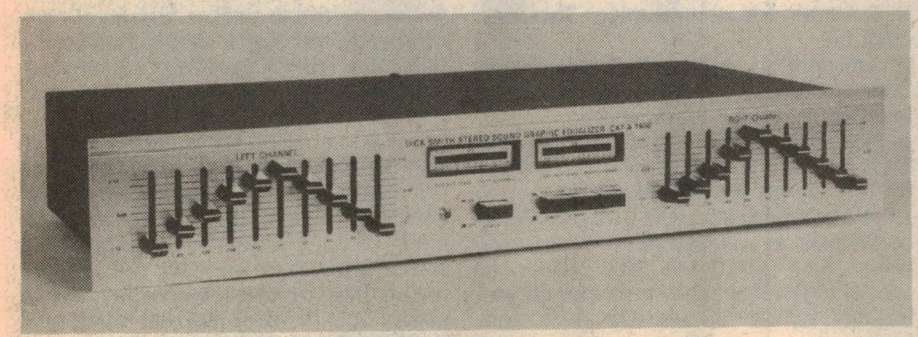
The Dick Smith A-1650 splits the audio spectrum into ten bands with the centre frequencies at 30Hz, 60Hz, 120Hz, 240Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz and 16kHz, which are the typical frequencies for ten band equalisers.

Each slider control has a quoted range of ±12dB at the centre frequency and has a centre detent allowing a flat response to be obtained.



The equaliser has nominal unity gain so that it can be switched into or out of the system with little or no effect on the overall gain, provided the controls are centered.

The overall dimensions of the A-1650 are 380 x 200 x 70mm (W x D x H). The size is mainly due to the amount of front panel space required by the twenty slider pots and the two VU meters.

The styling and the finish of the A-1650 are quite attractive with one minor exception. On the front panel next to the name Dick Smith is the catalogue number in the same bold type as the brand name. This does detract a little from the appearance of the unit, and I would have preferred to have seen just A-1650 indicating the model number instead of the rather imposing CAT. A-1650.

There is a lot of unused space inside the case with all the circuitry contained on four printed circuit boards. This includes two printed circuit boards for the slider pots.

Although no circuit diagram comes supplied with the unit (in fact the numbers on the ICs are blacked out with paint) it is quite easy to see that the conventional op-amp gyrator configuration is being used. In all there are 12 ICs on the main circuit board, all of which appear to be dual op-amps. Ten of those are used in the gyrator circuits while the remaining two appear to perform the functions of input preamplification and signal conditioning for the VU meters.

The fourth printed circuit board contains the power supply which consists of two regulated supplies for the op-amps. The general appearance of the inside of the case is a little untidy, but this does not detract from the performance.

The usual method of connection for an equaliser into a typical hifi system is to take the source signal from the tape output on the amplifier. This means that these sockets are no longer available for connection to the tape recorder. Generally one would find a duplicated set of sockets on the equaliser allowing the tape recorder to be connected here, but this is not the case with the A-1650. Although there are two sets of outputs, none of these duplicates the tape output of the amplifier.

Instead, there is an output selection system so that the signal from the equaliser can be fed to either of two outputs depending on the position of the output selector on the front panel.

This selection system is duplicated for the input circuit to the equaliser, thus allowing two sources to be selected, and after processing by the equaliser fed to the selected output.

The problem regarding connection of the tape recorder can be overcome by making a special lead that will allow the tape output of the amplifier to be connected to both the equaliser and the tape recorder.

On test the A-1650 performed well and met or exceeded all specifications: Signal-to-noise ratio with respect to 1V RMS was 102dB unweighted. Using the same reference level, the separation between channels was 90dB at 100Hz, 76dB at 1kHz and 57dB at 10kHz, measured with 4.7k loading the undriven input. Again, with respect the same input level, harmonic distortion was constant at .006% from 100Hz through to 10kHz and rose to .012% at 20kHz.

With the controls set for flat response, the gain of the equaliser is 0.5dB down. A 7-volt RMS signal can be obtained before more than .05% distortion is produced. This overload voltage is far in excess of what could be expected from any signal source within a typical hifi system.

Listening tests were done by the reviewer over a weekend using a typical hifi system in a domestic situation. Connecting the equaliser to the system made a really worthwhile difference. There was no perceptible noise and the equaliser performed extremely well.

In summary, we can state that the unit is a very good performer although ideally, for the best performance to be realised an equaliser needs to be used in conjunction with a room analyser. (An unabashed plug: The Playmaster Graphic Analyser, published in our February 1980 issue, is eminently suitable).

The recommended retail price of the A-1650 is $169 including sales tax.

The A-1650 is available at all Dick Smith stores and further information can be obtained from Dick Smith Electronics, Cnr Lane Cove & Waterloo Roads, North Ryde NSW 2113, or by writing to PO Box 321 North Ryde NSW 2113. (G. C.)

AUDIO ~ VIDEO ELECTRONICS

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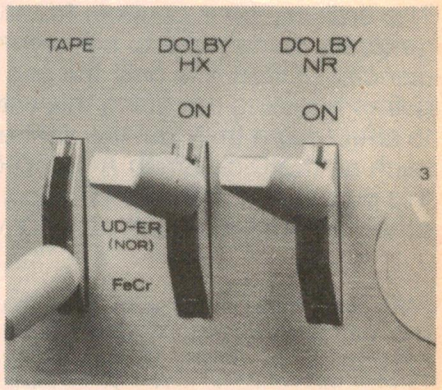
The Dolby HX system: another 10dB of high-frequency headroom?

The name "Dolby", already associated in many minds with background noise reduction in cassette decks, is now turning up in a new context: "Dolby HX", short for Dolby Headroom Extension. What are the implications of this new term?

by NEVILLE WILLIAMS



The name Dolby first hit the hifi headlines in the mid-sixties, with the release of Ray Dolby's A301 noise reduction system, intended primarily for use in professional recording studios.

In this sytem, the incoming audio signal was split into discrete audio bands, embracing low, middle and high frequencies. If the signal in any band fell below a predetermined level, the system would automatically increment the gain in that channel, and therefore the level of signal being fed to the tape.

For playback, the system operated in reverse, automatically lowering the gain for those signals which had been artificially boosted. In so doing, it also reduced the level of any tape hiss which might be present, thereby improving the signal/noise ratio, and the dynamic range of system as a whole.

While the A301 system soon made its mark in studios around the world, it was the release of the "-B" system which turned Ray Dolby's name into a hifi household word.

The much simplified Dolby-B circuit operated only over the treble register, but, in so doing, it diminished the high-pitched "ssssss" content of the hiss, making it subjectively much less apparent. It effectively improved the signal-to-noise ratio by about 10dB and, as applied to cassettes, is credited as being one of the major factors responsible for pushing the compact cassette to its present favoured position.

Thanks to solid-state circuitry, and in particular to microcircuitry, the Dolby-B noise reduction system is now incorporated, almost as a matter of course, into all but budget-priced decks. Its wide acceptance could well pave the way for the new "HX" system – circuitry mainly concerned with the recording bias but also having implications in terms of dynamic range.

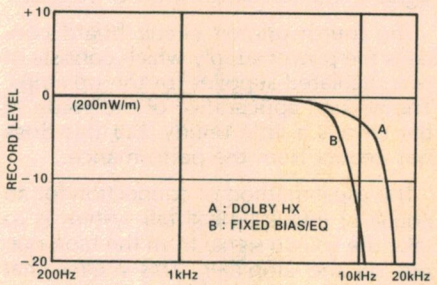
What's the connection?

During recording, the level of bias current required for any given class of tape is a matter for compromise. The bias must be:

- Sufficient to ensure that noise and distortion are reduced to a low level for low and mid-frequency signals;
- Not so high as to restrict unduly the MOL (maximum output level) of the tape for the highest signal frequencies.

But a compromise and a problem there certainly is, as will be evident to anyone who has studied the overall record/replay frequency response curves for any typical hifi cassette deck and tape.

When the test signal is recorded at the usual -20dB level, the replay curve is commendably flat from around 30Hz to, say, 15kHz. But if the same frequency run is repeated with the signal recorded at -10 or 0dB, a drastic fall-off in treble response becomes apparent.



A deck/cassette combination which may be flat to beyond 12kHz at a recording level of –20dB deteriorates to something like curve B at a recording level of 0dB. The Dolby HX system may restore the situation to approximate curve A.

What has happened is that, given the inherent tape characteristics, recording treble pre-emphasis and too much bias (ie for the treble end), a high-level high-frequency test signal simply pushes the tape into treble overload, saturation, demagnetisation, crushing – call it what you like!

In a home recording situation, provided the program to be recorded has been pre-monitored to conservative limits, and is not resplendent with treble, the effect of high frequency crushing is not too obvious. But it certainly will be, with an on-the-spot recording of a band or group, or with music like that found on a modern digital or direct-cut disc.

So why not relieve the situation by setting the bias at a level which will favour the higher frequencies?

Answer: Because the penalty would be higher distortion and higher noise level elsewhere in the spectrum.

The concept behind the Dolby HX system is to free the bias setting from its presently rigid compromise and to have the bias level constantly adjust itself to the needs of the signal being recorded.

When the signal is at a modest level and/or contains only a limited treble content, the bias would remain at its normal figure. In fact, say Dolby engineers, it may even be set somewhat above the accustomed compromise, to realise any further possible advantage in terms of reduced noise and distortion.

But, the instant a high-level high-frequency component appears in the signal, the bias is reduced accordingly, thereby increasing the ability of the tape to accommodate it. Hence the term HX

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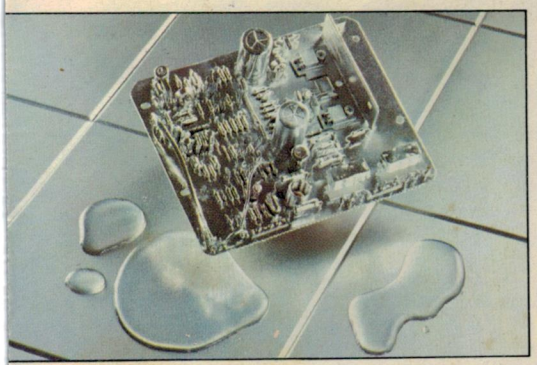

Sansui's AU-X1 is the DC amplifier in which current saturation is impossible. So TIM and envelope distortion are virtually nil. And accurate reproduction of musical signals reaches new levels.

THD and TIM

You're probably aware that THD specs only indicate an amplifier's response to simple steady state signals. But dynamic musical signals may generate music-smearing TIM.

TIM, transient intermodulation distortion, can be caused by pulsive musical signals which make ordinary amplifiers cry out in distress. And that means distressful music.

Sansui's powerful solution: the DD/DC circuit

The beauty of Sansui's exclusive DD/DC (Diamond Differential DC) circuit is it allows sufficient NFB for an ultra-low THD and — at the same time — stamps out TIM. The secret of DD/DC (PAT. PEND.)is driving power so powerful that current saturation is impossible. Slew rate: ±260V/μSec; Rise/fall time: 0.5μSec. THD: under 0.007% at full rated 160 RMS watts × 2 output. You hear unprecedented clarity and precision of detail.

Now look closely at the photo. What you thought were bass and treble controls, aren't. They are simply level controls. We admit the AU-X1 integrated amplifier is relatively austere. Because purity in reproducing the most demanding musical signals requires discipline.

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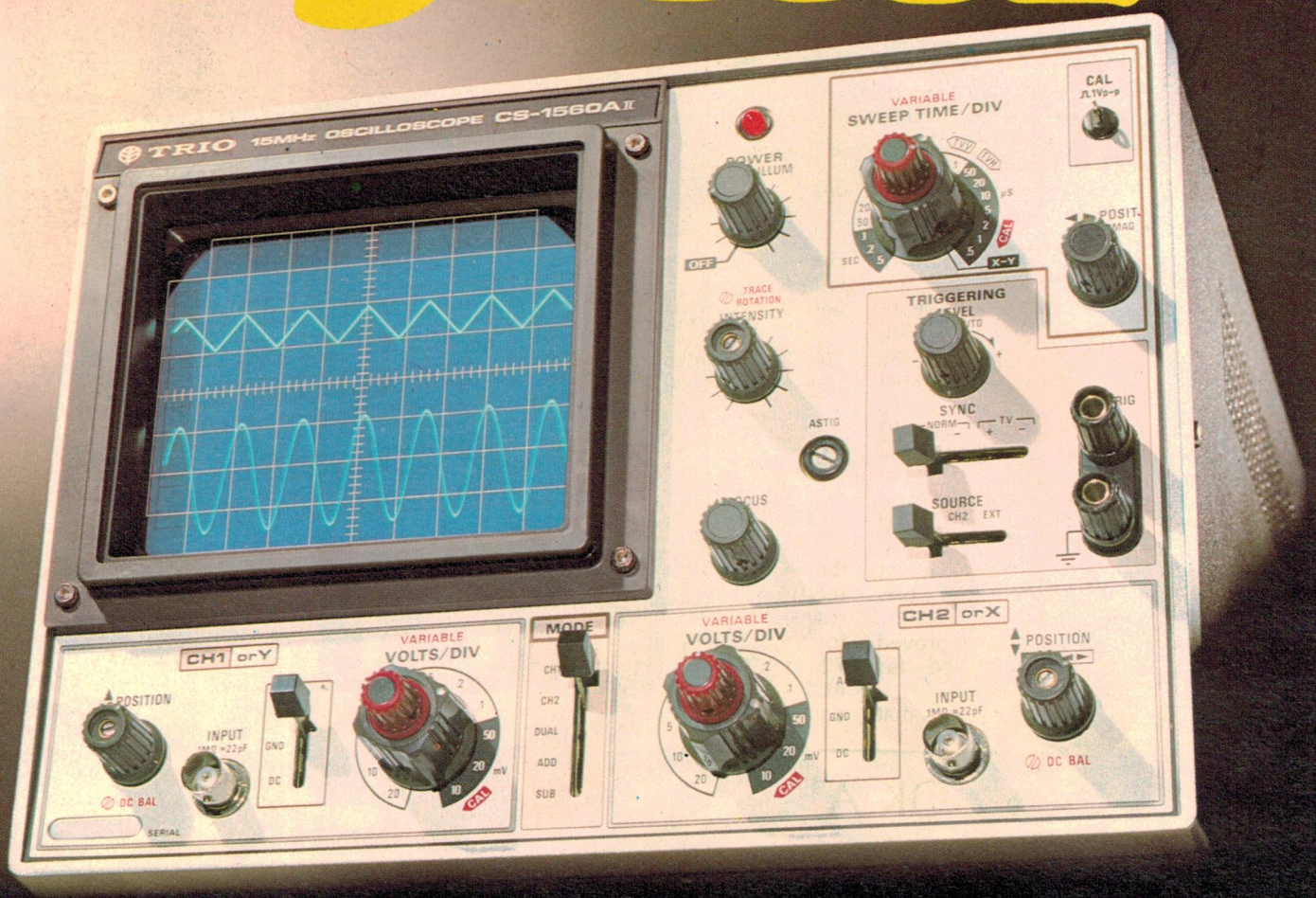

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– Headroom Expansion.

In fact, there is a double bonus: not only does reduction in the bias increase the MOL of the tape, but it also increases its effective sensitivity. As a result, the recording equalisation can be backed off, along with the bias, still further increasing the system's accommodation of high frequency signals. The improvement in headroom can be as much as 10dB above 10kHz.

The basic idea is not new but the Dolby organisation is in a unique position to capitalise upon it. The Dolby-B system already includes circuitry to sense the presence and amplitude of high frequency signals for the basic noise-reducing function as described earlier. It is but a further step to add provision to modify the bias and equalisation on a dynamic basis.

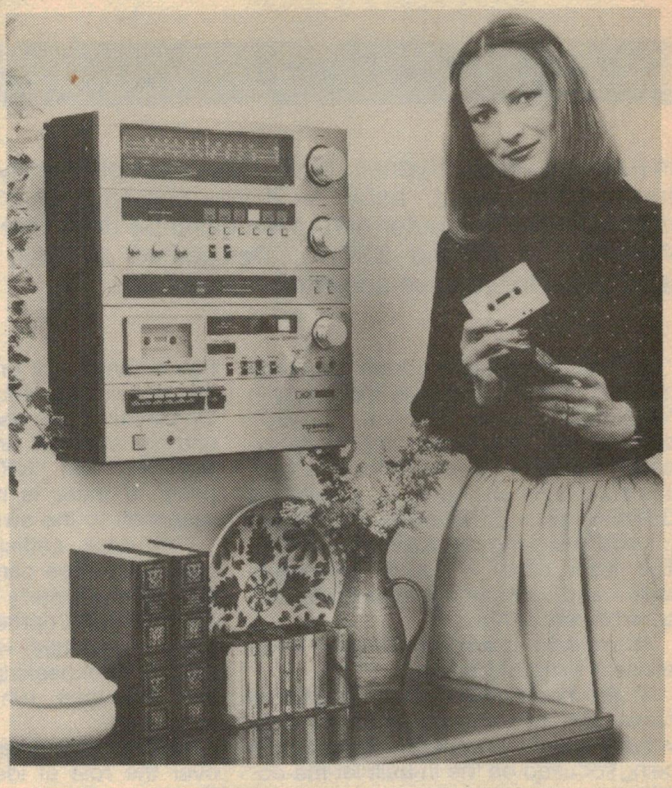
Reportedly, the provision of the HX facility in a new deck need add only about one third to the cost of the Dolby-B componentry that would be included anyway. Moreover, Dolby licencees can have access to the new technology without paying additional royalties.

It is admitted that reduction in bias to accommodate the high frequencies will cause some rise in noise and distortion in the low and middle register. However, Dolby engineers say that this is masked by the high frequency content and that, the moment the high frequency content and amplitude diminishes, the bias reverts to its normal level.

Subjectively, they say, the improved high frequency performance far outweighs any such shortcoming.

A point that needs to be made is that the HX system operates purely in the record mode. If correctly set up, the resulting cassette should be appropriate for normal Dolby replay with 120usec or 70usec equalisation, as appropriate for its type: ferric, chrome or chrome equivalent.

A new wall-mounting hifi system



Toshiba's new SK-01 system is intended to hang directly on the wall, being only 160mm deep by 420mm wide by 455mm tall. Weight is 10kg. For all its modest size, the system provides 25W per channel at 0.1% distortion, with full control facilities, even to a mic channel. The tuner provides FM-stereo and AM, while the cassette deck is metal compatible with Dolby NR. The price, $589. (From Toshiba Aust Pty Ltd, 16 Mars Rd, Lane Cove NSW.)

A FURTHER LOOK AT AM-STEREO

In our August issue, in these columns, we announced that the American FCC had nominated the Magnavox system as the one to be used for a future AM-stereo service. As matters transpired, by the time the issue went on sale, the FCC had begun to back-track on its decision, under pressure from interests whose systems had been rejected.

Magnavox are feeling doubly disadvantaged. Having battled for and won the decision, it now looks as though the contest is being re-opened. More than that, with so much pressure for a different verdict, they feel that they may no longer be able to count on an unbiased hearing.

Magnavox is not the only one dismayed. Chip designers at National Semiconductor, Sprague, Signetics and possibly other IC manufacturers had moved in quickly behind the decision favouring Magnavox, so as not to be disadvantaged. Certainly N/S had committed their design to silicon; now they're wondering whether they will find themselves back at square one!

Some of the pressure on the FCC is coming from AM broadcasters, allegedly with prodding by the Magnavox rivals. They point to the fact that the Magnavox system requires that the carrier never be cut completely during negative modulation peaks; this to preserve the FM "difference" component. Indeed, the restriction is reminiscent of the limit on negative TV picture modulation, necessary to safeguard the FM intercarrier sound signal in TV receivers.

AM broadcasters say that a requirement for 15% residual carrier in negative modulation peaks would significantly decrease the perceived loudness of their signals. This would reduce their coverage in areas where the signal had to compete with noise and interference. In effect, it would limit their range.

Magnavox counter this by saying that a 5% residual carrier will be adequate and that this will make negligible difference to the loudness and range of AM signals.

They also reject claims that their system will be unduly costly to established broadcasters; that an exciter for existing transmitters, plus monitor/instrumentation would add up to somewhere between $US4000-7000. The cost of re-equipping studios, program links, etc, will be the same irrespective of the transmission method chosen.

So AM-stereo is back on the agenda and, while the FCC deliberates, chip and equipment manufacturers will be sitting on their hands. Even if the Magnavox system gets the second nod, original schedules will have been set back.

But, if another system is preferred, the delay will lengthen into months.

In brief . . .

PHILIPS have received the Hi-Fi Grand Prix citation from the American electronics magazine "Audio Video International" for turntable technology . . . "for excellence in fidelity of sound reproduction, design engineering, reliability, craftsmanship, product integrity and cost performance". The award followed a poll of some 1500 speciality hifi retailers and receipt of more than 6000 votes. Subject of the award was Philips concept of "Direct Control" turntables which are belt driven by a DC motor. The motor, in turn, is speed controlled by a tachometer system incorporated under the turntable. This results in a wow and flutter figure of 0.03% and a rumble level better than −70dB (DIN B).

THE NAKAMICHI 1000ZXL

A recorder that computes — or a computer that records?

In a recent visit to Sydney, Mr E. Nakamichi personally (and proudly) introduced his latest "baby" — if you can apply that term to a highly sophisticated computer-controlled cassette deck that is likely to sell in Australia for around $3000. Designated as type 1000ZXL, it is scheduled for release sometime next month.

As will be apparent from the type number, the new deck is the latest in Nakamichi's top-of-the-line "1000" series — but it is larger and more expensive than its predecessors. In fact, it is quite an imposing brute, measuring 357mm (w) × 258mm (h) × 322mm (d) and weighing approximately 19kg. The front panel is black, Nakamichi style, and completely occupied with controls and lights.

As we said: imposing, although in no sense a thing of beauty.

At the presentation to the technical press, performance specifications were virtually taken for granted, with attention being focused on the in-built let-me-do-it-for-you microprocessor.

Nakamichi refer to the facility as the in-built "ABLE Computer", the acronym being built up from the words: Azimuth, Bias, Level and Equalisation.

To use the ABLE facility, the user slips in the blank cassette on which a recording is to be made and sets the playback equalisation knob to the appropriate position for the tape — 70*u*sec or 120*u*sec. A further knob setting indicates if noise reduction is to be used and whether in-built double Dolby or external Hicom II. The computer is then bidden to do its thing.

This it does in the space of something like 20 seconds. It records and plays back to itself tones which it uses to set automatically the playback head azimuth exactly to that of the record head. Then it carries right on to set the left and right channel bias, the NR signal level and the equalisation for an optimum flat response.

A whole string of "I'm doing it" lights in a panel at the top left flash in sequence while this is going on. Then there's a brief pause as the cassette is rewound to its start point and all the lights come on again, indicating a job well done. Playback equalisation is shown, also the type of noise reduction for which the system has been calibrated; the counter is reset to "0000", a "Standby" indicator lights, as also does the "Play" button, just waiting to be pushed, along with "Record".

When the recording is actually being made, the equalisation and noise reduction settings are encoded, along with the signal, as a subaudible frequency. On playback, the deck senses the code and adjusts itself accordingly, ignoring the "Eq" and "NR" switches on the panel. If there is no code, the deck responds to the switch settings.

The deck settings for up to four classes of tape can be retained in the computer's battery-sustained memory. Thus the appropriate settings may be recalled instantly, leaving the operator the option of peaking just the azimuth to suit the tape run in the individual cassette.

Another computerised function takes over the role of identifying and, later, finding program selections on a cassette, using an encoding signal on the tape. The cue can be inserted under manual control while recording, or as an automatic function.

In the latter mode, the circuitry interprets any break in the program of two seconds or more duration as an instruction to insert a cueing signal at that point. Up to 15 identifiable cues can be inserted on each side of the cassette. As the tape traverses, the progress of the cueing is registered on LEDs numbered one to 15, also in the upper left-hand panel.

Once a cassette has been provided with its sub-audible cues, it is a candidate for automatic replay at the whim of the user. Up to 30 instructions can be issued to the control computer nominating the tracks to be played, in what order, the number of times, and whether the deck is to repeat the exercise in continuous-play mode.

As each selection ends, the cue lights register the forwards/backwards search for the next track, until it settles on the one nominated. Once the selection has started, the display indicates the next track to be played in the sequence.

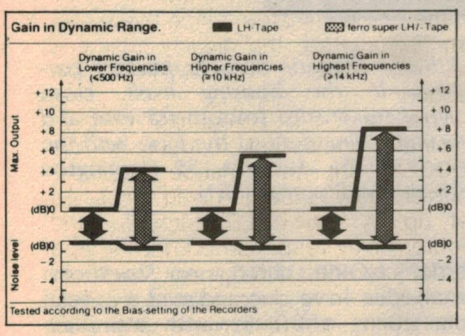
While the in-built computery tends to dominate one's first reaction to the 1000ZXL, the performance specifications are also in the gee-whiz class. As set up by the ABLE computer the record/replay response on quality tape (ferric, chrome, chrome equivalent or metal) is rated at plus and minus 0.5dB from 20Hz to 20kHz, with the 3dB points stretching out to 10Hz and 25kHz!

The recording bias used in the 1000ZXL is at 105kHz to minimise the risk of heterodyne "birdies" with the signal. The erase is at half this frequency, phase locked and fed to Nakamichi's "parametric" erase head, designed to provide a 10dB deeper erase than normal. In conversation, Mr Nakamichi said that the bias/erase system had a potential well beyond the needs of present-day metal tape and therefore the ability to cope with possible future tapes.

(For further details: Convoy International Pty Ltd, 4 Dowling St, Woolloomooloo, NSW 2011, Tel (02) 358 2088.)

The new BASF high precision cassette. An unbeatable case for buying The Green One.

Dubbed The Green One for ease of identification, the new BASF ferro super LH I displays high precision and performance throughout.



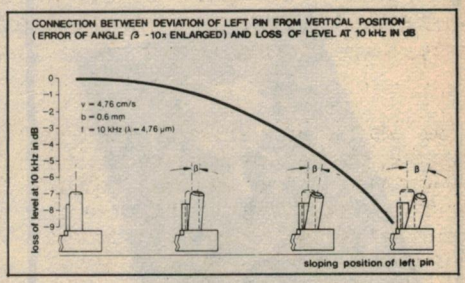
In the mechanics of the cassette, BASF has achieved new standards of azimuth precision, taking full advantage of the outstanding LH I quality.

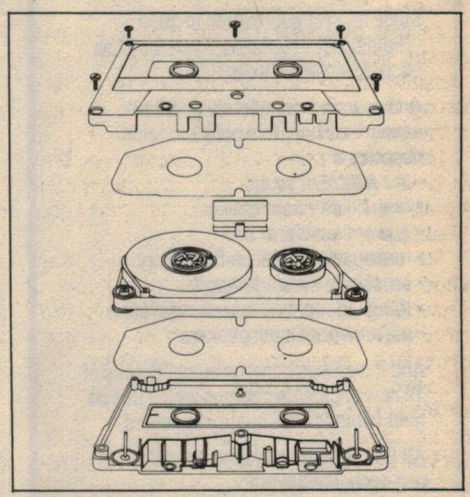
A dense coating of super-fine ferric oxide particles has produced a mirror-finish tape with extremely strong magnetic direction preference.

The end result – true Hi-Fi in the normal bias position I (Ironoxide or Fe 120 μs EQ). Plus higher volume levels with minimised distortion.

One common cassette fault. Deviation in vertical position of the pins diminishes high-frequency output, which results in loss of sound brilliancy. Minimum tolerances ensure that no fault can occur with the new BASF ferro super LH I.

In the tough, screw-together polystyrene, precision moulded shell, slip sheets eliminate tape edge damage. A mu-metal shield blocks stray magnetic fields. A felt pressure pad on a phosphor bronze spring ensures precise head contact on any deck. Flanged roller guides on lubricated stainless steel pins provide precise tape feed and azimuth alignment.





The patented BASF Security Mechanism (SM) prevents scrambling of tape and guides the tape smoothly within the cassette. A large strong window gives clear visibility to the best BASF ferro super I tape yet.

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Quality across the range.

Go for The Green One. Step up to Hi-Fi precision.

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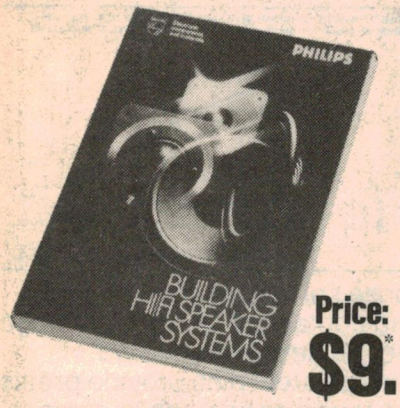

Price: $9.*

Since its first publication in 1969 "Building Hi-Fi Speaker Systems" has become a classic in its field.

And now, in a completely updated seventh edition, this book contains chapters on:

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- high fidelity and realism
- power considerations
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And it includes constructional details of 19 new enclosure designs which can be built using Philips quality speakers.

All this in plain language for the non-technical layman.

This book is a definite must for anyone who wants a superior sound system at less cost and, at $9.00*, you have nothing to lose, and a new fund of knowledge to gain, even if you have no plans to get into home construction.

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Please send me a list of Philips dealers where I may purchase this book and further information on Philips loudspeakers.

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From BASF — "The Green One"

In November 1977, we reported research in progress at the BASF tape factory in Germany aimed at developing a cassette tape which would match the higher average bias levels in typical Japanese decks. The tape was to be known as "Ferro super LHI" and was due to be released in the first half of 1978. While retaining the same concept and type number, BASF have up-dated and re-styled the product and given it the distinctive name "The Green One". They claim that Ferro Super LHI represents ferric tape at its best, with critically aligned, densely packed particles. In the housing itself, close tolerances ensure smooth traverse and accurate alingment of the tape with the heads. (BASF Australia, 55 Flemington Rd, Nth Melbourne 3051).

IAC INQUIRY: The Minister for Industry and Commerce, Mr Philip Lynch, announced recently that a reference concerning long-term assistance for the production of loudspeakers and loudspeaker enclosures had been sent to the Industries Assistance Commission.

In making the announcement, he pointed out that, when the IAC reported on monochrome receivers and certain electronic components in April 1977, it had stated that the assistance then applying to loudspeakers and loudspeaker enclosures should be reviewed in three years time. That action is now being taken.

The IAC has been asked to report back to the Government within 12 months from the date of receipt of the reference.

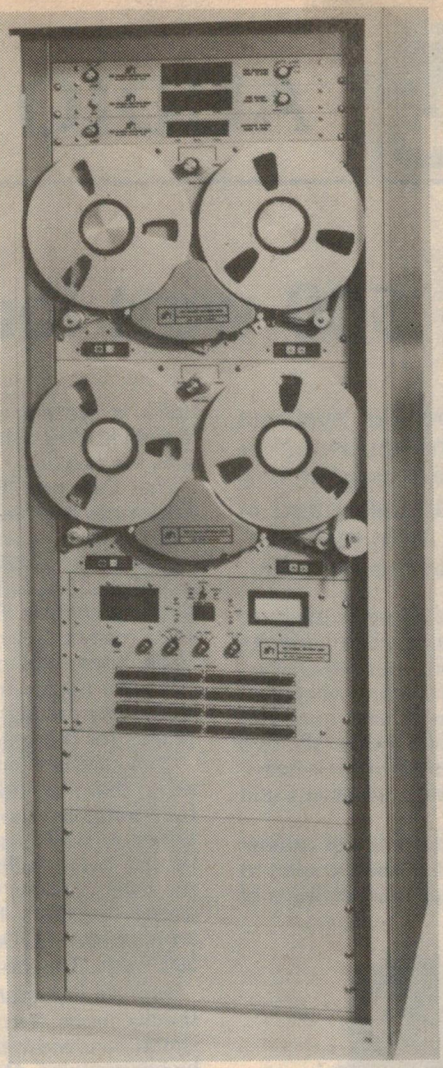
PHILIPS NORRKOPING, near Stockholm in Sweden have concentrated a special engineering effort towards improving the quality of sound available from domestic television receivers. They have pushed up the available audio power to about 10 watts RMS and have also studied the problem of producing loudspeakers with improved overall performance – despite the constraints that are imposed by the usual TV cabinet and picture-tube structure. FM demodulators have also come in for close attention, to rid them of some of the spurious hums and noises which can creep through, due to the interaction of sound and picture signals.

The engineering team is also looking at the possibility of achieving compatible

L&D Audio Distributors Pty Ltd are marketing a new range of L&D quality loudspeaker systems. Distribution will be through hifi dealers. The complete range is to include up to 10 models, ranging in price from $199 per pair to $499 per pair for a 12-inch 4-way system. Some models include horn and dome tweeters, wide-angle mid-range drivers and generously rated woofers. For details: Mr Len Deitch, L&D Audio Distributors, 24 Enterprise Ave, Padstow 2211. Tel. (02) 771 3999.

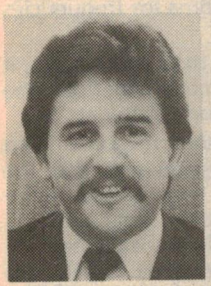
An ear that never misses a word

Claimed to be the largest capacity voice logging recorder in the world, this model CRM 5600 from the Stancil-Hoffman Corporation can record 56 voice channels plus a digital time code on standard 2.54cm tape. Up to 24 hours of recording can be captured on a single 1100m reel, with performance specs. that exceed those of many smaller capacity units. Apart from the unit shown, a single deck desk-top model is available as is a portable reproducer. Details from Peter Schaper at Rank Electronics Pty Ltd, 12 Barcoo St, East Roseville, NSW. Phone (02) 406 5666.



FM stereo sound. The Japanese have already suggested a "piggy-back" FM/FM system adapted from present-day sound FM-stereo broadcasting. However, opinion in Europe tends to favour an extra FM sound carrier, slotted into the existing channel space. But stereo sound for TV may well remain, for the time being, in the "too hard" basket!

SANYO AUSTRALIA PTY LTD have appointed Graeme Boucher as their Product Manager for hifi components and in-car entertainment equipment. Graeme Boucher started with Haco-Hagemeyer in 1972, transferred to Hitachi in 1976, and then joined Sanyo in 1979 as hifi and car-sound representative for Victoria. Now, as Product Manager for Australia, he sees his task as being "to consolidate and elevate the acceptance of the Sanyo name in the marketplace". He can be contacted at Sanyo Australia Pty Ltd, 225 Miller St, North Sydney. Phone 02 436 1122.



Graeme Boucher

Paul Wilcock

TDK (AUSTRALIA) PTY LTD have named Paul Wilcock as their marketing manager, with the task of maintaining and increasing TDK's already high profile in the audio and video cassette market. TDK is at 4 Dowling St, Woolloomooloo, NSW 2011.

RANK ELECTRONICS PTY LTD have supplied the Darwin Community College FM station with a Collins 831 D2 2.5kW FM transmitter and a G4CPL-8 – 8-bay circular antenna. The operating frequency is 104.1MHz, and the ERP 11.2kW in the horizontal plane.

For the studio, a Broadcast Electronics 8S250 console with turntable equipment and 2100 Series cartridge machines have been selected. In addition to the BE equipment, two Urei LA4, 1176LN limiter compressors, Tandberg TD20 and 440A open reel and cassette recorders with Altec model 7 monitors have been installed.

Executive officer at the college is Rob Milliken and the callsign sought is 8 DCR FM. (For further information on equipment, contact Kevin Sylvester at Rank Electronics Pty Ltd, 12 Barcoo St, Chatswood, NSW. Phone 02 406 5666. Also in other capitals).

SANYO AUSTRALIA PTY LTD is to be a major sponsor of the 12th Commonwealth Games, to be held in Brisbane in 1982. The Managing Director of Sanyo, Mr S. Hashimoto, and the Marketing Manager of the Commonwealth Games Foundation, Mr Michel Browning, signed an agreement by which Sanyo TV equipment will be used for the Games. The agreement includes the supply of monitors for the press and Games administration, and the supply of official video cassette recorders. Scheduled dates for the games are September 30 to October 9, 1982.

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20,000 people have bought over 1,000,000 cassettes from us. They all can't be wrong. $1 spent could save you hundreds.

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Celestion P1 500 watt loudspeaker

We have reviewed many loudspeaker systems over the years but this professional loudspeaker system from Celestion is easily the biggest, the most efficient and the most generously rated in terms of power handling capacity. With that combination of characteristics, it is also the loudest.

The Celestion P1 is built with just one purpose in mind: to make very loud noises on stage. The bands who use it and the fans who listen may have different opinions, but either way, this loudspeaker system is capable of producing very high sound pressure levels. It is so big and heavy that it comes in two parts which are stacked, one on top of the other. The two cabinets are constructed from 18mm plywood which is heavily braced and lined with foam to minimise resonances and colouration.

Both cabinets have recessed handles and the lower cabinet has castors for manouverability. Even so, it takes two men to lift and carry each cabinet and taking them up several flights of stairs as we did is heavy work. Each enclosure is stated as weighing 60kg although it seemed to us that the top enclosure was the heaviest.

Mary Farrell, one of the Sungravure staff, stands just 156cm high in her bare feet. By comparison, the Celestion P1 is not small.

The Celestion P1 is a four-way system with the lower enclosure handling frequencies below 250Hz. It uses two 38cm (15in) woofers which are vented to provide bass response below 50Hz. The upper cabinet is sealed and houses a 30cm (12in) driver which handles the frequencies from 250Hz to 850Hz. From 850Hz to 5kHz, the output is handled by a really massive cast double-flared horn oriented to give wide horizontal dispersion. The frontal dimensions of this horn are approximately 41 x 15cm. No doubt the weight of this heavy casting plus the two cast high frequency horns accounts for the greater weight of this enclosure.

Both cabinets have grille cloth frames which can be removed so that the audience can see what they are being blasted by. Certainly, they do look more impressive without the grilles. As well as having the two woofers mounted on the baffle, the lower enclosure has two large knobs which function as the level controls for the upper midrange horn and high frequency tweeters. Rounding off the visual appeal is a vertical array of seven LEDs calibrated at 10, 20, 40, 80, 150, 300 and 500 watts. This display can be switched off if desired.

Nominal impedance of the Celestion P1 is not stated in the specifications. We measured the impedance curve over the stated bandwidth of the system and obtained a curve which is highly irregular. At the bass resonance of about 50Hz, the impedance peaks at about 18 ohms, which is not unusual. But between 80Hz and about 250Hz the impedance dips below four ohms with the minimum value less than three ohms. At higher frequencies, the impedance again dips to a minimum of five ohms at 3kHz and to less than five ohms for frequencies between 8kHz and 18kHz.

Clearly, if the Celestion P1 is to be used to full advantage, it must not only be driven by a very powerful amplifier but one which is not at all troubled by very low load impedances.

While the system has a claimed frequency response from 40Hz to 20kHz, within ±dB, our impression was that the sound reproduction was coloured, mainly by peakiness in the horn radiators. However, we think that this characteristic is unlikely to reduce its usefulness as a stage loudspeaker system for live music. Indeed, it will probably enhance it, as far as musicians and their audience are concerned. It goes almost without saying that the bass response is very strongly maintained down to below 50Hz.

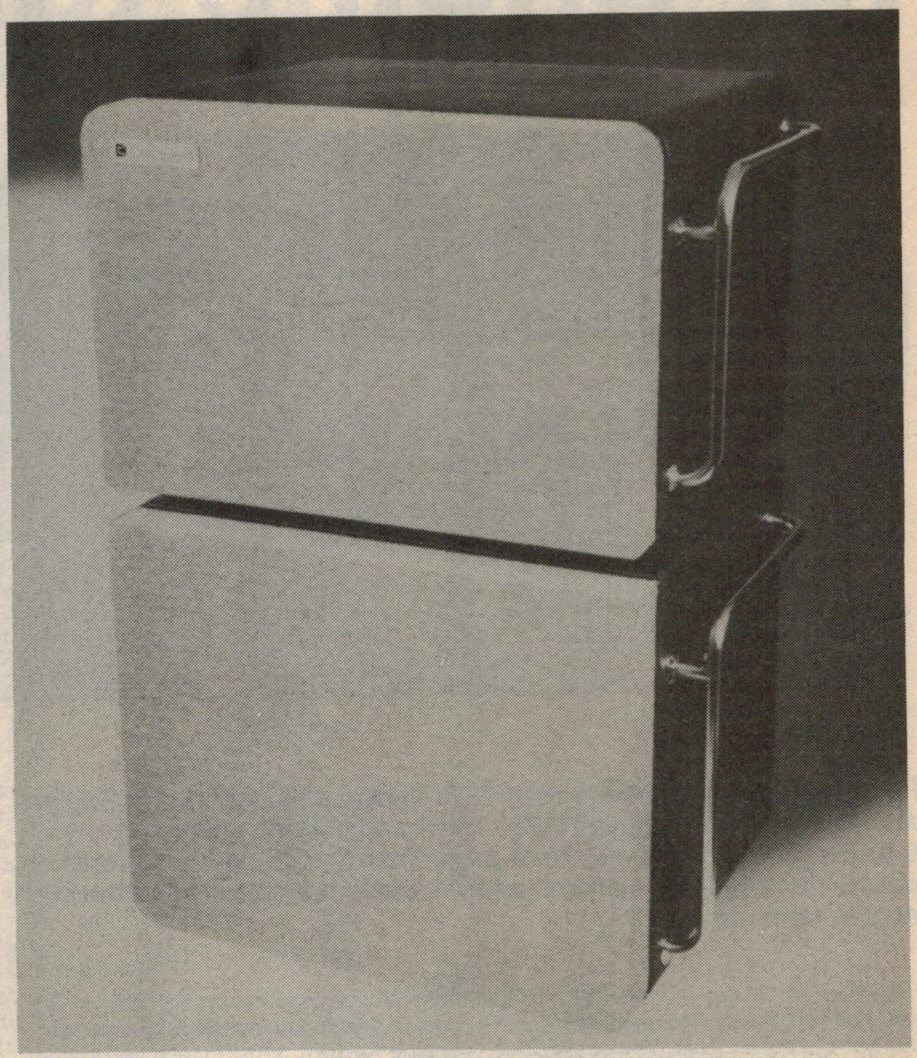
We drove the system with the most powerful amplifier we had on hand, which was the Playmaster 300, delivering 300 watts into four ohm loads. On sinewaves, the P1 can easily handle all that this amplifier can give and more! And the efficiency is really something to write home about. Even at one watt on program material it is loud, with a quoted sensitivity of 101dB. At 100 watts, it was painfully loud, even at quite a distance away. Higher powers than that we don't want to talk about.

In conclusion, those who want an extremely rugged loudspeaker system for stage use should consider the Celestion P1. It is available in fully assembled or kit form. Prices on application to M & G Hoskins Pty Ltd, 268 Princes Highway, Arncliffe or their showroom at 400 Kent Street, Sydney.

Celestion P1
High performance professional 500 Watt loudspeaker system

P1

The Celestion P1 is a professional loudspeaker system combining high efficiency with high power handling capacity.
The system is constructed in two halves for the users convenience and is available in 3 different finishes.
Black Ash or American Walnut give an attractive appearance for permanent and semi permanent disco installation in hotels, clubs and discotheques.
Alternatively a hard wearing 'Ambla' material finish is suitable for group public address.
The system can be used with upper and lower grilles removed if preferred.



Cabinets
Both cabinets are constructed from 18mm Plywood making them strong and inert. The enclosures are lined with 50mm thick foam to damp out standing waves and minimize colouration.

Dividing Network
The dividing network consists of 4 separate filters and contains a total of 18 elements.
The bass units are fed from a third order Butterworth filter. Two third order band pass filters are used for the two mid range sections and a third order high pass filter for the treble units.
Compensation networks have been used to ensure that the filters feed into as near resistive loads as possible.

Control Panel
A panel, mounted on the baffle behind the grille on the bottom cabinet, provides level controls for the treble and for the upper mid range sections.
In addition there is a L.E.D. display calibrated in watts, corresponding to the peak input power supplied to the system.

SPECIFICATION

Power Handling :	Suitable for amplifiers up to 500 watts continuous sine wave
Impedance :	8 ohms
Frequency Response :	40HZ-20kHz ± 6dB
Crossover Frequencies :	250Hz, 850Hz, 5kHz – 4 way system
Sensitivity :	101dB at 1 metre for 1 watt
Finish :	Black Ash, American Walnut, 'Ambla' covered

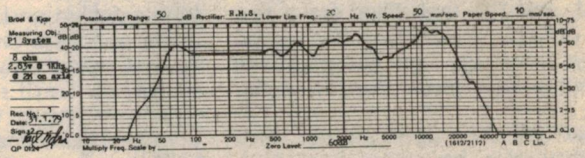
Lower cabinet

Loudspeakers :	2 x Celestion G15-100
Overall Dimensions :	H 26¾ inches W 33¾ inches D 25 inches 680mm 857mm 635mm
Internal Volume :	10.8 cubic feet 305 litres

The low frequency performance is optimised in a 305 litre ported reflex design extending the bass response to below 50Hz.

Upper cabinet

Loudspeakers :	1 x Celestion G12-125 (lower mid range) 1 x Celestion DC100 2 x Celestion HF20
Overall Dimensions :	H 22½ inches W 33¾ inches D 25 inches 857mm 635mm
Internal Volume :	9.0 cubic feet 255 litres



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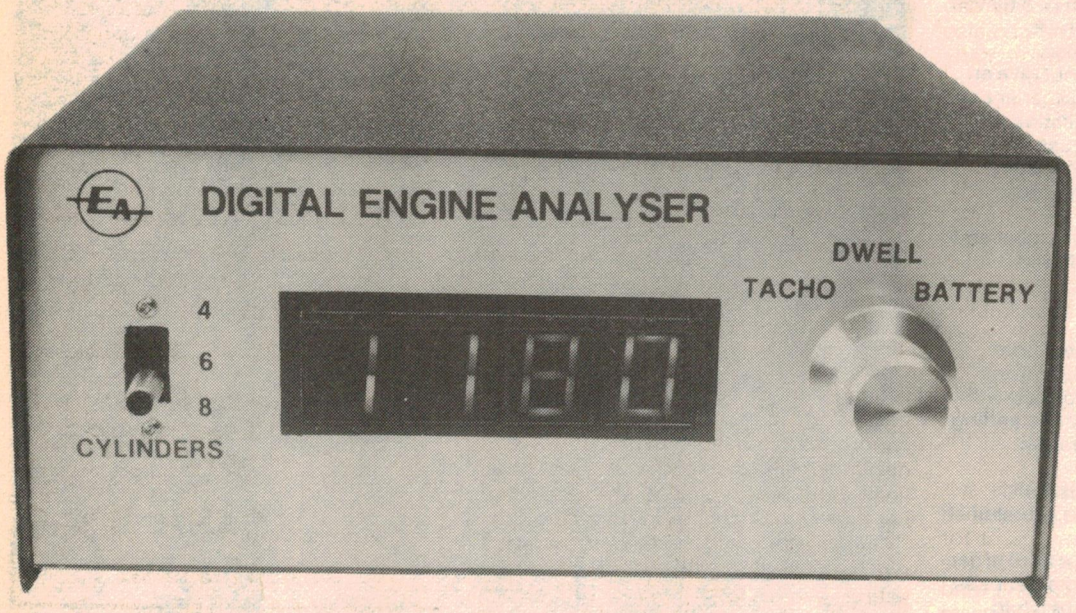
DISPLAY SHOWROOMS: 400 KENT STREET, SYDNEY 2000. 268 PRINCES HIGHWAY, ARNCLIFFE 2205.

Celestion

Tacho/dwell meter for engine tune-ups



- ☆ Easy to build
- ☆ 4 digits
- ☆ LED display
- ☆ Measures rpm, dwell & voltage

Featuring a bright, easy-to-read LED display, this new Digital Engine Analyser measures engine RPM, dwell and battery voltage on any 4, 6 or 8-cylinder petrol engine. It is compatible with both electronic or conventional ignition systems and will save you money on petrol and engine tune-ups.

circuit by RON DE JONG
article by GREG SWAIN

Once upon a time, when the world was not too much younger, you could buy petrol very cheaply. You could drive into Fred's Friendly Fill-up, have the windscreen cleaned, the oil and tyres checked, and the tank filled for a few measly dollars. Those were the "good old" days when the flow meter on the petrol pump spun faster than the dollar meter.

But that was once upon a time. Since then, petrol prices have risen dramatically and, at the current price of 33 or 34 cents per litre, filling up the family car is an expensive business. And it's going to get even more expensive – did someone say much more expensive? – in the near future.

Against this background, our new Digital Engine Analyser is bound to prove popular. In fact, we're rather proud of the instrument. Among the features it boasts are an easy-to-read, 4-digit LED display, and provision for measuring engine RPM, dwell and battery voltage on 4, 6 and 8-cylinder engines. Combined with an ignition timing light, it will enable you to accurately tune your car's engine for best performance and reduced fuel consumption.

At today's petrol prices, correct engine tune quickly translates into real on-road dollar savings (a badly tuned engine can have a devastating effect on fuel consumption). You'll save money by doing your own engine tune-ups too. In fact, our new Digital Engine Analyser will probably pay for itself in a very short time.

One important feature of the unit is that it is compatible with all current electronic ignition systems, including breakerless systems and transistor-assisted and capacitor discharge systems in which the points are retained. Only three leads are required to connect the unit for use: two to the battery and the third to the points or to the transistor side of the ignition coil in the case of a transistorised system.

To explain further, for conventional and CDI systems the lead is connected to the points; for a breakerless electronic system, the lead is connected to the coil (ie across the coil switching transistor); and for a transistor-assisted system the lead can be connected either to the points or to the ignition coil.

The tachometer and dwell ranges both use the same engine connections, except for TAI systems which have dwell extension. In one position, the dwell meter will give the duty cycle of the points; in the other (ie to the coil), it will give the extended dwell reading. The tachometer reading will be the same from either input.

ENGINE TUNING

Engine tuning usually involves little more than replacement of the points, followed by adjustments to the ignition system and engine idling speed. Once the points have been replaced, the first step is to set the dwell to the manufacturer's specifications. On Holden 6-cylinder engines, for example, this will be somewhere between 30° and 35°; for 4-cylinder engines the dwell angle will

be somewhat higher, typically around 55°.

Dwell is simply the angle of rotation of the distributor shaft while the points are closed during each ignition cycle. All one has to do is adjust the points gap until the specified reading is indicated on the Analyser (or rather the reading falls within the manufacturer's recommended range).

Correct dwell adjustment is important. Too small a dwell angle, for example, will result in less current passing through the coil, with consequent poor ignition through loss of spark energy. This can cause misfiring at high RPM and can also make an engine hard to start, particularly in cold weather.

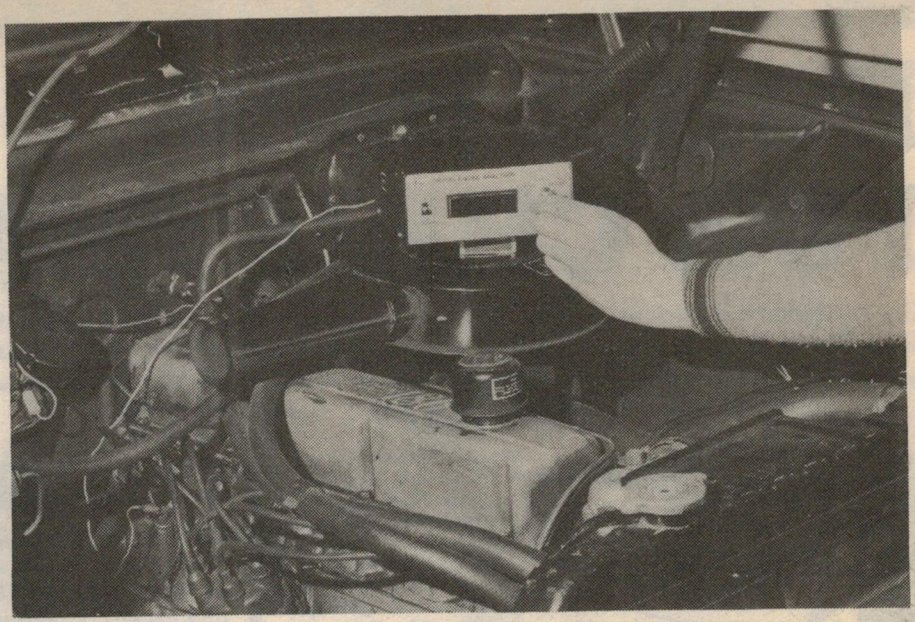
On the other hand, too large a dwell angle will result in higher currents which may lead to excessive arcing and pitting of the points at low engine speeds, again resulting in loss of spark energy.

This is where electronic ignition systems can offer superior performance. Our own Transistor-Assisted Ignition system (Dec, 79), for example, maintains spark energy at a very high level, even up to very high engine speeds, by using "dwell extension". Thus, with TAI and CDI systems, it will only be necessary to set the points dwell somewhere in the "ballpark".

The "tacho" range is essential for setting the engine idling speed, an adjustment which is particularly important for cars with automatic transmission. If the idling speed is too high, the car will tend to "creep" more than normal and waste petrol; if it is too low, the engine will run roughly, have a tendency to stall, and have higher than usual bearing wear.

Ignition timing adjustments also require the use of a tachometer, since timing is usually carried out at a specified engine speed. Make sure that you set the dwell before making ignition timing adjustments, as dwell affects timing (although the converse is not true). You should also make sure that all engine adjustments are carried out according to the manufacturer's specifications.

Invest in a workshop manual if you don't have one.



Three leads connect the unit for use – two to the battery and the third to the points side of the coil. The air cleaner is usually a convenient place to rest the instrument.

We estimate that the current cost of parts for this project is about

$45

including sales tax

HOW IT WORKS

Fig. 1 shows a simplified block diagram of the tachometer circuit, and the various signal waveforms involved. Input to the tachometer is obtained from across the points (say), and the circuit counts the number of times the points open (ie the number of sparks) within a fixed "gating" interval. This gating interval is set so that, for a given spark rate, the meter will display RPM directly.

The gating signal and two other "housekeeping" signals – the latch enable and reset signals – are obtained from a master clock which drives a counter and associated gating circuitry. The sequence of these housekeeping signals is as follows: First the gating signal arrives and pulses from the input circuit clock the counter; then, as soon as the gating signal is finished, the latch enable goes high and the contents of the counter are transferred to latches and displayed (ie, the reading is updated); finally, the reset signal goes high, clearing the counter for the next cycle.

One problem with this scheme is that if we were to directly display RPM, the gating period (and hence the update time) would be quite long. In the case of a 6-cylinder engine, for example, 50 sparks per second corresponds to 1000 RPM. Thus, for the counter to read 1000, we would need a gating period of 1000/50 or 20 seconds!

This figure is much too long to be practical and must be reduced. Our circuit overcomes the problem in two ways.

Firstly, the first digit of the display has been set permanently to zero and the circuit arranged so that the first digit of the counter drives the second digit of the display (more on this later). This step not only reduces the required count (and hence the gating time) by a factor of 10, but also reduces display "bounce" due to small variations in engine idle speed.

Secondly, we introduced a phase locked loop (PLL) immediately after the input buffer. The PLL increases the apparent spark rate by multiplying the input frequency, and thus reduces the gating time even further.

Since the gating period is kept constant, a different multiplier factor must be used for each different engine category. For a 4-cylinder engine there are two sparks per engine revolution, three for a 6-cylinder, and four for an 8-cylinder.

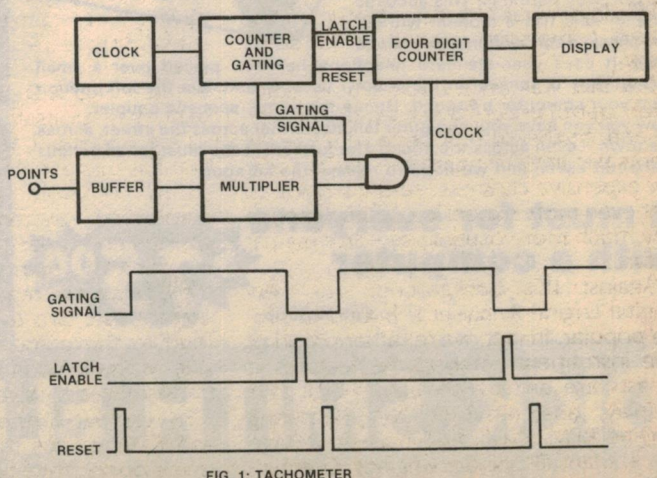


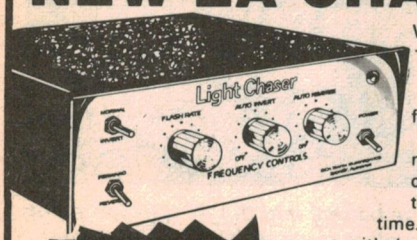
FIG. 1: TACHOMETER

Fig. 1 (right): how the tachometer function works. The input frequency derived from across the points is buffered, multiplied by a PLL, and gated through to the display circuitry. Different multipliers are used for 4, 6 and 8-cylinder engines.

BUILD NOW FOR CHRISTMAS!

Get ready for the Christmas festivities and save $$$! You'll be surprised at how easy a Dick Smith Kit is to build; and your Christmas bill won't cost you a fortune!!!

NEW EA CHASER

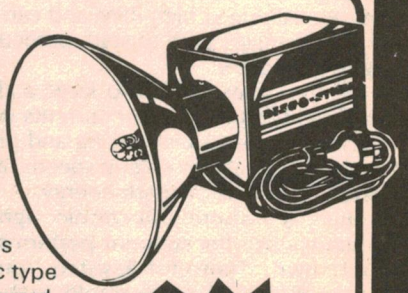


What a way to add life to your next Christmas party with this incredible Light Chaser. Features include reverse/forward chasing, variable flash rate control plus an invert/normal switch. This switch can make two lights appear to move instead of one at a time. The versatility is increased with 'auto reverse' & 'auto invert' functions. When either control is switched on, the unit will automatically inverse or reverse the display at any set rate. All this makes it a worthwile project that will save $$$ and give hours of entertainment.

$69.50

Cat. K-3145

ETI STROBE



Get your Christmas party swinging with this superb Disco Strobe. This popular kit contains up-to-date circuitry and comes complete with photographic type reflector, perspex safety guard and instructions. Vary the flash rate to the beat of your music.

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EA MUSIC COLOR

K-3140

Turn your music into a light show. This unit will accept an audio input from almost any amplifier and uses the information to control 3 channels of colour. The ideal unit for your Christmas or New Year's party, disco, bands etc etc. Also makes an ideal present.

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Ideal for discos, parties etc. Use with your Musicolor. Available in 4 colours: yellow, red, blue, & green.

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HOLD IT!

Line socket for bayonet mount lamps makes it ideal for running wander light leads for loft & outside. Ideal for holding standard colour globes for parties, Xmas decorations outside etc.

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P-5510

OTHER EXCITING DICK SMITH KITS...

ACOUSTIC COUPLER

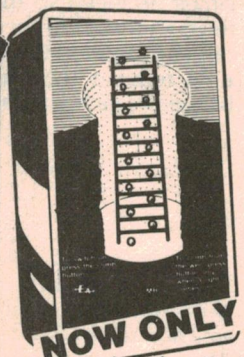
We've lost count of the number of customers who have asked for this project: well here it is! This acoustic coupler acts like a modem without any physical connection to the phone lines. It uses your standard telephone handset, placed over a small microphone & speaker in the coupler case, & transfers the information from your computer by sound. Hence the name, acoustic coupler.
Now you can have your computer talk to another across the street, across the town – even across the country (or further!) It is a must for all serious computer users, and we hope to release the kit soon.

A must for everyone with a computer

$75.00

Cat. K-3605

LEDS & LADDERS GAME



One of our most popular kits of the past was the intriguing 'LEDS & LADDERS' game described in EA in 1975. Now EA have come up with a new version of the game which is not only easier to build, it is also easier to play! Can you climb out of the well without being plummeted down again?

AND NOW FOR THE BEST NEWS: This kit is actually $1.00 cheaper than it was in 1976 – despite 4 years of inflation! Makes an ideal gift.

Was $16.75 in 1976

$15.75

Cat. K-3390

DICK SMITH ELECTRONICS

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These figures mean that for a given input frequency, engine RPM is obtained by multiplying by 30, 20 and 15 for 4, 6 and 8-cylinder engines respectively.

By choosing a gating period of 0.5s, these figures translate into required PLL multiplication factors of 6, 4 and 3.

In essence then, the tachometer is a frequency meter, but with the addition of a frequency multiplier in the input stage.

DWELL METER

Fig. 2 shows the basic scheme for the dwell meter section of the engine analyser.

Dwell is actually a measure of the duty cycle of the points and is measured in degrees of distributor camshaft rotation. Our circuit measures dwell by simply filtering the waveform across the points to give a DC voltage proportional to the duty cycle and then measuring this voltage to give a reading in degrees. In fact, the dwell meter section of the circuit functions in exactly the same manner as a digital voltmeter.

The dwell meter uses the same basic housekeeping circuit as the tachometer but, in addition, includes a ramp generator, comparator, divider and a low pass filter (LPF). Gating is derived from the comparator, which has one input connected to the LPF and the other connected to the ramp generator.

At the heart of the dwell meter circuit is an analog-to-digital converter (ADC) which functions as follows: After the counter has been reset to zero, the ramp voltage at the inverting input of the comparator increases linearly with time. During this time, the gating signal is high and the counter is clocked. The ramp voltage continues to rise until it equals the DC voltage from the LPF, at which point the gating signal goes low and stops the counter.

The point behind all this is that the length of the gating period will be proportional to the voltage output of the LPF, which in turn is proportional to the dwell – the very thing that we wish to measure.

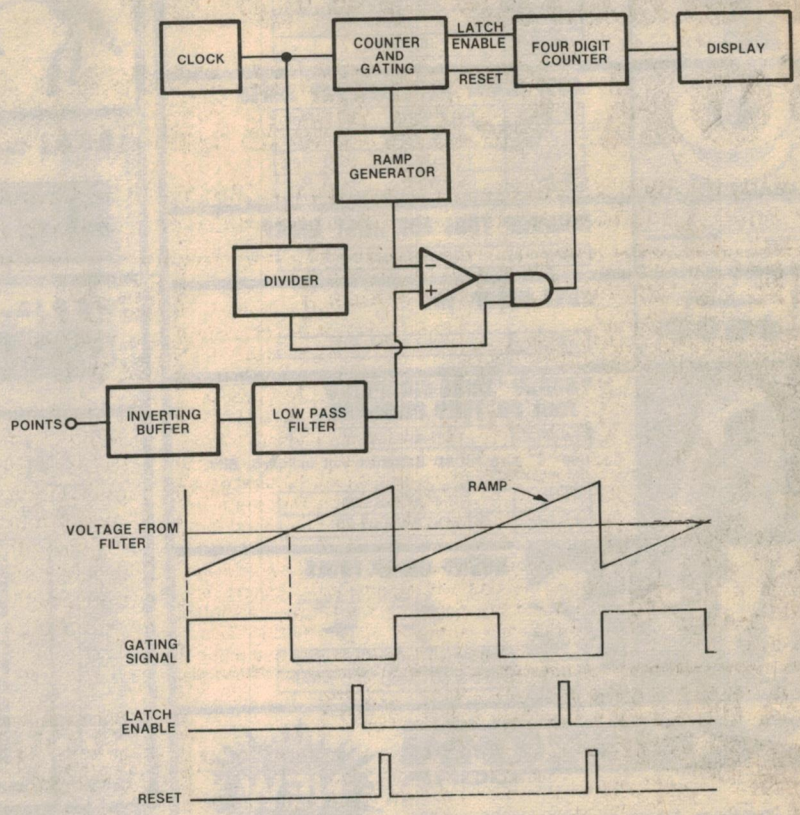


FIG. 2: DWELL METER

So that the circuit will give a direct reading in degrees for 4, 6 and 8-cylinder engines, we have included a divider which divides down the clock signal before passing it to the gate. The appropriate division factors can be worked out by simply noting that for a 100% duty cycle – ie points permanently closed – the dwell angles would be 90° for a 4-cylinder engine, 60° for a 6-cylinder engine and 45° for an 8-cylinder engine. After setting the counter and gating circuit to divide by 512, the division factors used were 4, 6 and 8 for 4, 6 and 8-cylinders respectively.

While developing the dwell meter circuit we realised that, since it includes a fairly accurate A-to-D converter, we might as well take advantage of the situation and add a battery voltage range. This range works in exactly the same way as the dwell meter, except that the clock signal passed to the gate does not come from the "Cylinder preset" divider but from the counter following the clock.

THE CIRCUIT

To see how we have implemented the various functions refer now to the circuit diagram. The clock, which provides timing for the whole unit, consists of a 555 timer IC wired as an astable multivibrator. Calibration of the tachometer is performed by adjusting the frequency of the oscillator using trimpot VR1. Note that this adjustment does not affect the dwell or battery voltage ranges, because the ramp signal is also derived from the clock.

The counter and gating section of the circuit consists of a 4040 binary ripple counter (IC1), a 4001 quad NOR gate (IC5), and a 4011 quad NAND gate (IC4). The NAND and NOR gates decode the outputs of the ripple counter to obtain the gating, latch and reset signals for IC2, the 4-digit counter. IC4a provides the

SPECIFICATIONS

MEASURING FUNCTIONS:

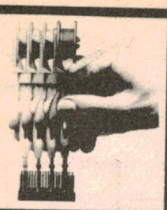
Tachometer — 360-9,990RPM on 4, 6 or 8-cylinder engines.
Dwell Meter — 0-90° (4-cylinder); 0-60° (6-cylinder); 0-45° (8-cylinder).
Battery Voltage — 9-20V; 0.1V resolution

COMPATIBILITY:

Compatible with 4, 6 and 8-cylinder petrol engines; Kettering and electronic ignition systems (includes breakerless ignition); and both negative and positive earth vehicles.

ACCURACY:

Tachometer: ± 10RPM — Dwell Meter: ± 1° — Battery Voltage: ± 0.1V.



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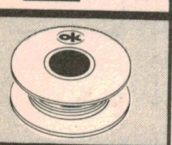
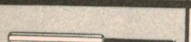
JW-1-Y	YELLOW WIRE
JW-1-R	RED WIRE



JUST WRAP REPLACEMENT ROLLS

R-JW-B	BLUE WIRE	50 ft. Roll
R-JW-W	WHITE WIRE	50 ft. Roll
R-JW-Y	YELLOW WIRE	50 ft. Roll
R-JW-R	RED WIRE	50 ft. Roll



UNWRAP TOOL FOR JUST WRAP

JUW-1	UNWRAPPING TOOL

JUST WRAP KIT

JWK-6	JUST WRAP KIT

"HOBBY" WIRE WRAPPING TOOL BATTERY POWERED

BW-2630	FOR AWG 26-30

Use "C" size NICAD Batteries, not included. Bits not included.

BT-30	BIT FOR AWG 30
BT-2628	BIT FOR AWG 26-28

HOBBY WRAP TOOLS

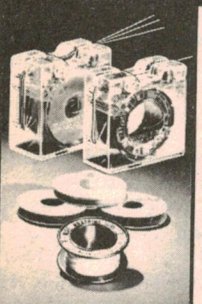
WSU-30	REGULAR WRAP
WSU-30M	MODIFIED WRAP

XURON CORP.

NEW

Cutters have a new patented shearing action

- Very thin profile
- Low operator fatigue
- Low cost
- Long life



TRI-COLOR DISPENSER

WD-30-TRI	TRI-COLOR DISPENSER
R-30-TRI	REPLACEMENT ROLLS

WIRE DISPENSER

WD-30-B	BLUE WIRE
WD-30-Y	YELLOW WIRE
WD-30-W	WHITE WIRE
WD-30-R	RED WIRE

DISPENSER REPLACEMENT ROLLS

R-30B-0050	30-AWG BLUE 50 FT. ROLL
R-30Y-0050	30-AWG YELLOW50FT.ROLL
R-30W-0050	30-AWG WHITE 50 FT. ROLL
R-30R-0050	30-AWG RED 50 FT. ROLL

*KYNAR-PENNWALT

HOOK-UP WIRE

HK-18	18 AWG	25 FT.	SOLID CONDUCTOR
HK-20	20 AWG	25 FT.	SOLID CONDUCTOR
HK-22	22 AWG	50 FT.	SOLID CONDUCTOR
HK-24	24 AWG	50 FT.	SOLID CONDUCTOR
HK-26	26 AWG	50 FT.	SOLID CONDUCTOR
SHK-18	18 AWG	25 FT.	STRANDED CONDUCTOR
SHK-20	20 AWG	25 FT	STRANDED CONDUCTOR
SHK-22	22 AWG	50 FT.	STRANDED CONDUCTOR
SHK-24	24 AWG	50 FT.	STRANDED CONDUCTOR
SHK-26	26 AWG	50 FT.	STRANDED CONDUCTOR

PRB-1 DIGITAL LOGIC PROBE

- DC to > 50 MHZ
- 10 Nsec. pulse response
- 120 K Ω Impedance
- Automatic pulse stretching to 50 Msec.
- Automatic resetting memory
- Open circuit detection
- Automatic threshold resetting
- Compatible with all logic families 4-15 VDC
- Range extended to 15-25 VDC with optional PA-1 adapter
- Supply O.V.P. to ± 70 VDC
- No switches/no calibration

PRB-1	DIGITAL LOGIC PROBE

PROTOTYPE BOARD CM-100

TERMINALS: 1,020 TEST POINTS. 188 separate 5 point terminals, plus 2 horizontal bus lines of 40 common test points each.

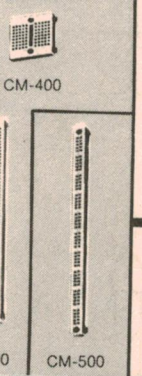
SIZE: 6½" Wide, 5" Long.

CM-100	MODULAR PROTOTYPE BOARD

PROTOTYPE BOARD CM-200

TERMINALS: 630 TEST POINTS. 94 separate 5 point terminals, plus 4 bus lines of 40 common test points each. SIZE: 6" Wide, 3½" Long.

CM-200	MODULAR PROTOTYPE BOARD



PROTOTYPE BOARD CM-300, CM-400

CM-300 and CM-400 have two separated rows of five interconnected contacts each. Each pin of a DIP inserted in the strip will have four additional tie-points per pin to insert connecting wires. They accept leads and components up to .032 in. diameter. Interconnections are readily made with RW-50 Jumper Wire. All contact sockets are on a .100 in. square grid (1¾ in. wide).

CM-300	MODULAR PROTOTYPE BOARD
CM-400	MODULAR PROTOTYPE BOARD

MODULAR BUS STRIP

CM-500 is a bus strip to be used in conjunction with CM-300 and CM-400 for distribution of power and common signed lines. Two separate rows of common terminals, grouped into clusters of five. All contact sockets are on a .100 in. square grid.

CM-500	MODULAR BUS STRIP

DIP IC INSERTION TOOLS WITH PIN STRAIGHTNER

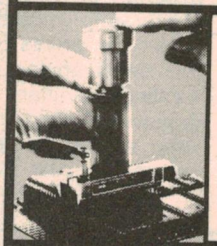
Narrow profile. Pin straightener built into tool. Automatic ejector.

INS-1416	14-16 PIN DIP/IC INSERTER

MOS, CMOS-SAFE

GROUND STRAP NOT INCLUDED

MOS-1416	14-16 PIN, MOS CMOS SAFE INSERTER
MOS-2428	24-28 PIN, MOS CMOS SAFE INSERTER

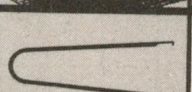


36-40 PIN CMOS-SAFE IC INSERTION TOOL

Aligns bent out pins. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

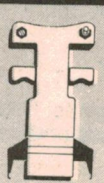
MOS-40	36-40 PIN CMOS SAFE INSERTION TOOL



DIP IC EXTRACTOR TOOL

Extracts all LSI, MSI and SSI devices of from 8 to 24 pins.

EX-1	EXTRACTOR TOOL



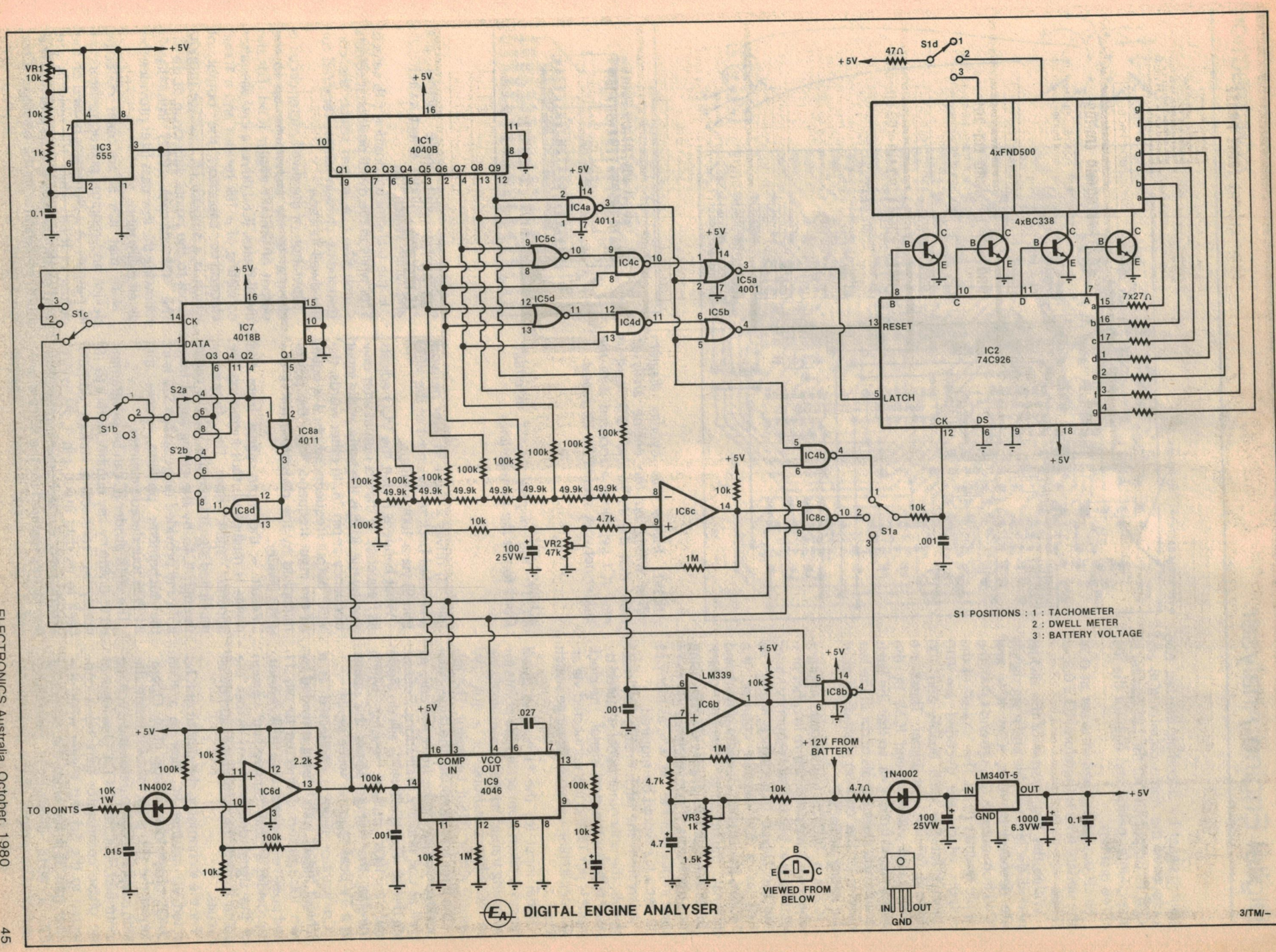
24-40 CMOS-SAFE EXTRACTOR TOOL

Removes 24-40 pin IC's, .600" centers. C-MOS safe. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

EX-2	CMOS SAFE EXTRACTOR TOOL

AMPEC ELECTRONICS PTY. LTD. 1 Wellington Street, Rozelle, 2039. Tel: (02) 818-1166.
Available from: NSW David Reid Electronics, 29-6601. Radio Despatch Service, 211-0191. Martin De Launay, 29-5834. Applied Technology, 487-2711. **VIC.** Stewart Electronics, 534-3733. Ellistronics, 602-3282. **S. Aust.** Protronics, 212-3111. **W. Aust.** Reserve Electronics, 328-3116. Taimac Electronics, 328-1988 **QLD.** N.S. Electronics, 36-5061.



DIGITAL ENGINE ANALYSER

3/TM/–

gating signal by decoding the last two outputs of the ripple counter (Q8 and Q9), its output low for the last quarter of the counter period and high for the first three quarters.

Since the gating period is set at 0.5s, the update time is therefore 4/3 x 0.5, or 0.66s.

Within this last quarter of the divider period, the latch enable and reset signals are decoded by IC5c, IC5d, IC4c and IC4d from outputs Q5, Q6 and Q7 of the ripple counter (IC1). The "states" of the outputs which are decoded are 010 (binary) for the latch enable and 100 (binary) for the rest signal. These are then gated via IC5a and IC5b by the gating signal from IC4a, so that the latch enable and reset signals occur in the last quarter of the counter period (ie after the gating period).

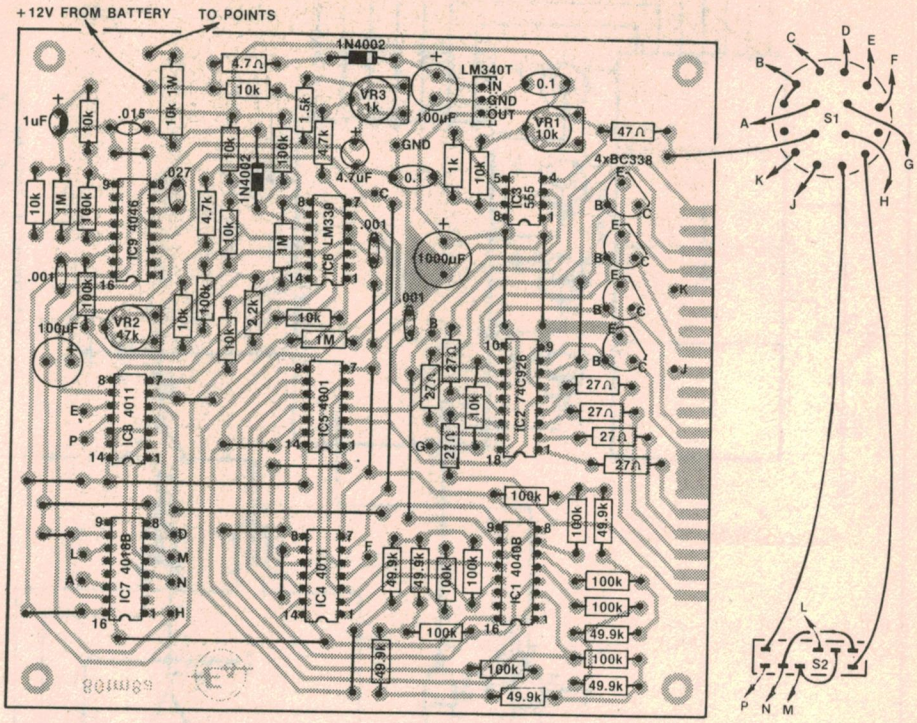
IC2 is a 74C926 four-decade counter which we have used before in other projects such as our Digital Frequency Meter and the Digital Capacitance Meter. As well as a four-decade counter, the 74C926 has latches, decoder drivers and internal multiplexing circuitry which drives a 4-digit LED display directly using four transistors. If conventional ICs were used in place of the 74C926, as many as 12 extra ICs would be required.

Apart from the latch enable and reset signals, the only other signal required by the 74C926 is the clock signal. The clock input is pin 12 and it is connected via an RC "deglitching network" to range switch S1a.

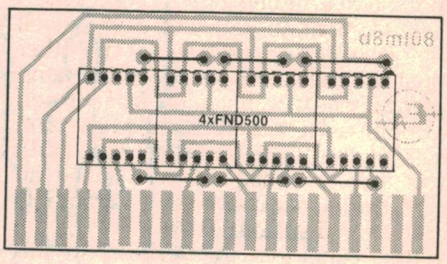
Signal input for the tacho and dwell ranges is taken from across the points (or switching transistor) and passes firstly via an RC filter consisting of a 10k 1W resistor and a .015uF capacitor. The job of the filter is to attenuate the large initial positive voltage spike from the coil, as well as coil primary oscillations. Following the RC filter is a 1N4002 silicon diode and a 100k pull-up resistor which translate the voltage across the points to a 5V peak "square" wave signal.

Comparator IC6d is connected as a Schmitt trigger with biasing provided by two 10k resistors connected to pin 11 and positive feedback via a 100k resistor. It provides a clean "squared-up" version of the signal derived from across the points to both the tachometer and dwell circuits.

For the tachometer, the output of IC6d is fed via another RC filter to a 4046 CMOS phase locked loop (IC9). Operation of the PLL is as follows: Inside the 4046 is a phase comparator and a voltage controlled oscillator (VCO). One input of the phase comparator (pin 14) is connected to the Schmitt trigger while the other (pin 3) is fed from the output of IC7, a 4018 divide-by-N presettable counter. The output of the comparator (pin 13) drives a lag-lead filter network and is fed back to the input of the VCO (pin 9) via a 100k resistor.



ABOVE: follow this overlay diagram when wiring up the engine analyser. Note that the 49.9k and 100k resistors near IC1 (ie, those associated with the ladder network should be 1% types).



RIGHT: the display board assembly. Don't forget the six wire links.

What happens is that the VCO adjusts its frequency so that its output after division by the 4018 is the same as the input frequency at pin 14. In other words, the VCO output frequency at pin 4 is equal to the input frequency from the points multiplied by the division factor of the 4018 divider.

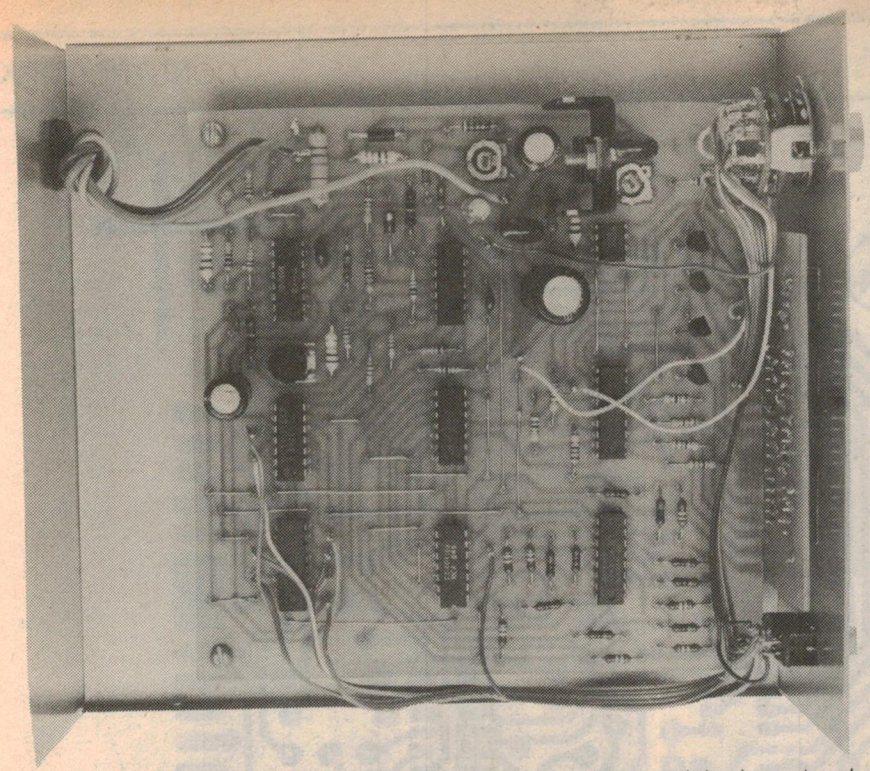
Result – the input signal from the points is multiplied, thus increasing the apparent spark rate. This frequency multiplied signal from the VCO is gated through IC4b by the gating signal from IC4a and provided range switch S1a is in the tachometer position, clocks the 74C926 four-decade counter.

The 4018 divider IC can be programmed to divide by any number from 2 to 10 simply by connecting various outputs back to its data input, pin 1. As we've already seen, the tachometer multiplication factors required for the PLL are 6, 4 and 3 for 4, 6 and 8-cylinder engines respectively, and these factors are selected by cylinder select switch S2b and range switch S1b.

In the tachometer position S1b selects S2b, while in the dwell position it selects switch S2a. S2a in turn selects the corresponding division factors required for the dwell function.

Operation of the dwell meter circuit is identical to the tachometer up to the output of Schmitt trigger IC6d. For the dwell meter, IC6d drives a low pass filter consisting of a 10k resistor and a 100uF electrolytic capacitor, the output of which is a smooth DC voltage proportional to the points duty cycle or dwell. The 47k trimpot (VR2) immediately following the low pass filter provides the dwell calibration.

Note that IC6 is an open collector device and requires pull-up resistors on its outputs. A 2.2k resistor is used on the output of IC6d, while 10k resistors are used on the outputs of IC6b and ICc. The fourth comparator in the package, IC6a, is not used.



Rainbow cable can be used to complete the internal wiring, while the points lead should be rated at 240V. The PCB assembly is mounted using 25mm brass spacers.

PARTS LIST

1 metal case, 184 x 160 x 70mm
1 PCB, 80tm8a, 136 x 133mm
1 PCB, 80tm8b, 82 x 46mm
1 4-pole, 3-position rotary switch
1 2-pole, 3-position slide switch
1 Scotchcal front panel
1 47k miniature horizontal trimpot
1 10k miniature horizontal trimpot
1 1k miniature horizontal trimpot
4 12mm brass spacers
2 car battery clips
1 alligator clip
1 heatsink for voltage regulator
1 rubber grommet

SEMICONDUCTORS
1 74C926 CMOS counter latch multiplexer
1 4040B CMOS binary ripple counter
1 4018B CMOS divide by N counter
1 4046 CMOS phase locked loop
2 4011 CMOS quad NAND gates
1 4001 CMOS quad NOR gate
1 LM339 quad comparator
1 555 timer IC
4 FND500 common cathode displays
1 LM340T-5 5V three-terminal regulator
4 BC337 or BC338 transistors
2 1N4002 rectifier diodes

CAPACITORS
1 1000uF/6.3VW PC electrolytic
2 100uF/25VW PC electrolytic
1 4.7uF/25VW PC electrolytic
1 1uF/25VW tantalum
2 0.1uF greencap (metallised polyester)
1 0.037uF greencap
1 0.015uF greencap
3 .001uF greencap

RESISTORS (¼W, 5% unless stated)
3 x 1M, 4 x 100k, 9 x 100k 1%, 7 x 49.9k 1%, 10 x 10k, 1 x 10k 1W, 2 x 4.7k, 1 x 2.2k, 1 x 1.5k, 1 x 1k, 1 x 47 ohm, 7 x 27 ohm, 1 x 4.7 ohm

MISCELLANEOUS
PC stakes, ½-metre of rainbow cable, machine screws, hoop-up leads, etc.

NOTE: Where specified, the "B" suffix on a CMOS IC part number indicates that only a buffered device should be used.

Output from the low pass filter passes to the non-inverting input of IC6c, which is the comparator depicted in the dwell meter block diagram (Fig. 2). The other input to the comparator is the ramp voltage which is obtained from a network of resistors connected to the outputs of the 4040 ripple counter (IC1). This resistor configuration is called an R:2R ladder network and is commonly used as an analog to digital (A to D) converter. Note that the resistors in this network require 1% tolerance.

IC6c provides the gating signal to NAND gate IC8c. When the gating signal is high, the signal from the 4018 divider is gated through IC8c to clock the 74C926 counter. The counter is stopped when the output of IC6c goes low, ie when the ramp voltage is equal to the voltage from the low pass filter.

The battery voltage measuring circuit works in exactly the same manner as the dwell meter, but uses comparator IC6b and a low pass filter consisting of a 10k resistor and 4.7uF electrolytic capacitor. Trimpot VR3 provides calibration, while clock signals are derived from the Q1 output of the 4040 binary counter rather than directly from the clock. This last step is to make maximum use of the voltage range of the ramp.

The power supply is straightforward and consists of a LM340 three-terminal regulator which provides the regulated 5V supply for the CMOS circuitry. Filtering is provided by the 100uF and 1000uF capacitors, while a 1N4002 silicon diode provides protection against reverse polarity battery connection.

Before leaving the circuit description, we should mention two points. The first concerns the phase-lock loop IC (4046). When no signal is present from the points, ie, when the motor is not running, the VCO "free runs". This produces a reading on the display of about 310 to 360 RPM. However, immediately the engine is started the PLL will lock to the input signal and produce a valid reading.

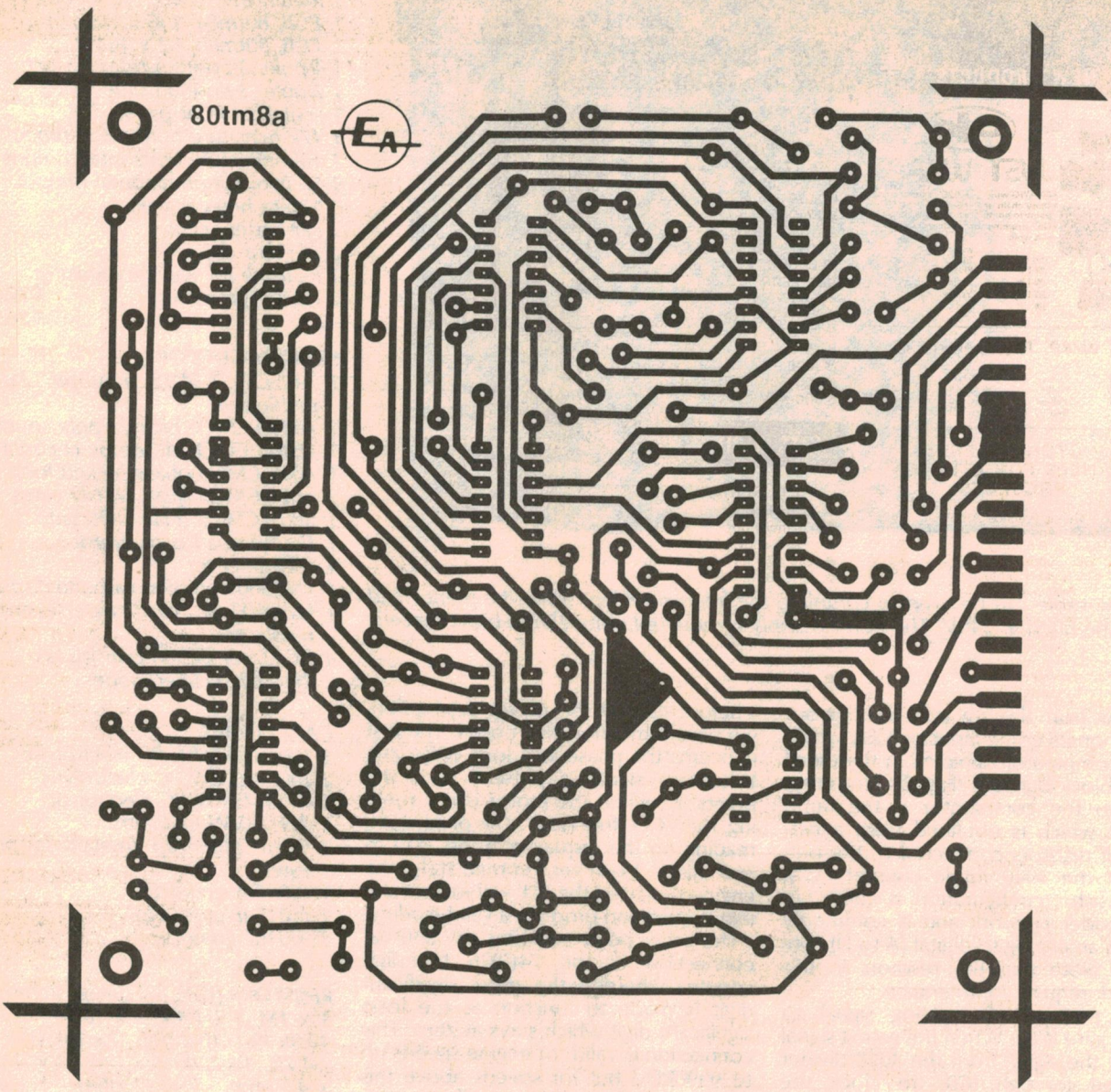
The other point concerns the unusual connection of the 74C926 four-digit counter whereby the most significant digit is made to function as the least significant digit which stays at zero. This connection is valid for engine speeds up to 9990RPM but for speeds above this range, the 74C926 counter will overange onto what in this circuit is the first digit. This means that an engine speed of 10,000RPM will produce a reading of "0001".

While some readers may regard this as a disadvantage we do not think it is serious. Few motors are capable of this speed and in any case, this instrument is really intended for stationary testing, where these engine speeds could not be used without serious danger of damage to the engine.

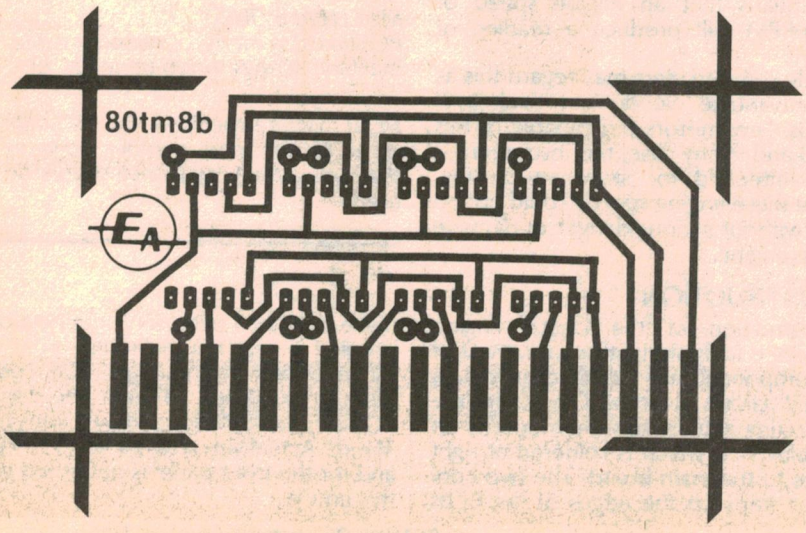
CONSTRUCTION

Construction of the Digital Engine Analyser is fairly straightforward. Most of the components are mounted on a main printed circuit board (PCB) while the seven-segment displays are mounted on a display PCB which is soldered at right angles to the main board. The two connector strips on the edges of the PCBs make all the necessary connections, keeping wiring to a minimum.

Dimensions of the main PCB coded 80tm8a, are 136 x 133mm. The display PCB is coded 80tm8b and measures 82 x 46mm. Actual size artwork for both PCBs and for the front panel is published with this article.



Here are actual size artworks for the main PCB (top) and the display PCB (below).



Commence construction by assembling the display PCB. Install the six wire links first, followed by the FND500 displays. Make sure that the displays are soldered and mounted flush against the PCB so that they will line up correctly with each other.

Mount all the components on the main PCB next, leaving the CMOS ICs till last. The LM340T regulator requires a heatsink and this can be made from a small piece of aluminium bent in a U-shape. Take the usual precautions when soldering the CMOS ICs: avoid handling the pins; earth the barrel of your soldering iron to the earth track on the PCB using a clip lead; and solder the supply pins (see circuit) first. Make sure that all polarised components (electrolytic capacitors, transistors, ICs) are correctly oriented or damage may result.

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JW-1-R	Red	24.99

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R-JW-Y	Yellow	50 ft. roll	4.99
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DIG CAPACITANCE METER

Kit of parts featured in Electronics Australia March, 1980. Four digits.

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BD140 10 up	5.50
SC141D 10 up	11.00
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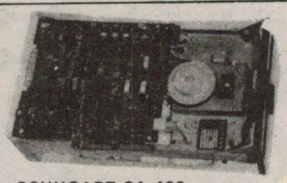

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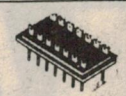

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Values may be mixed.

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19-key pad includes 1-10 keys ABCDEF and 2 optional keys and a shift key.

ideal for dream project

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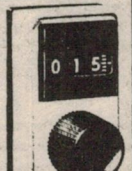

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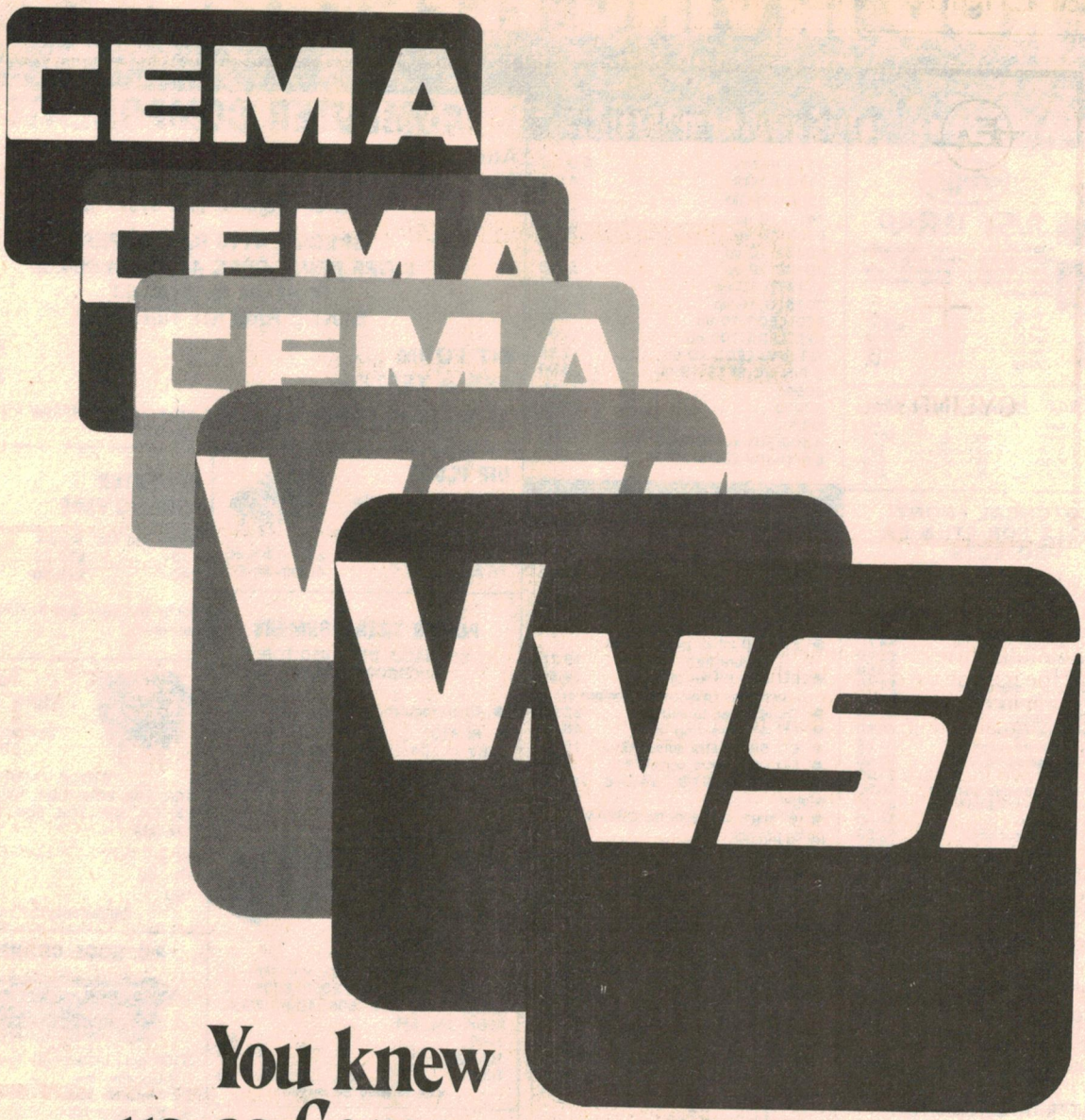

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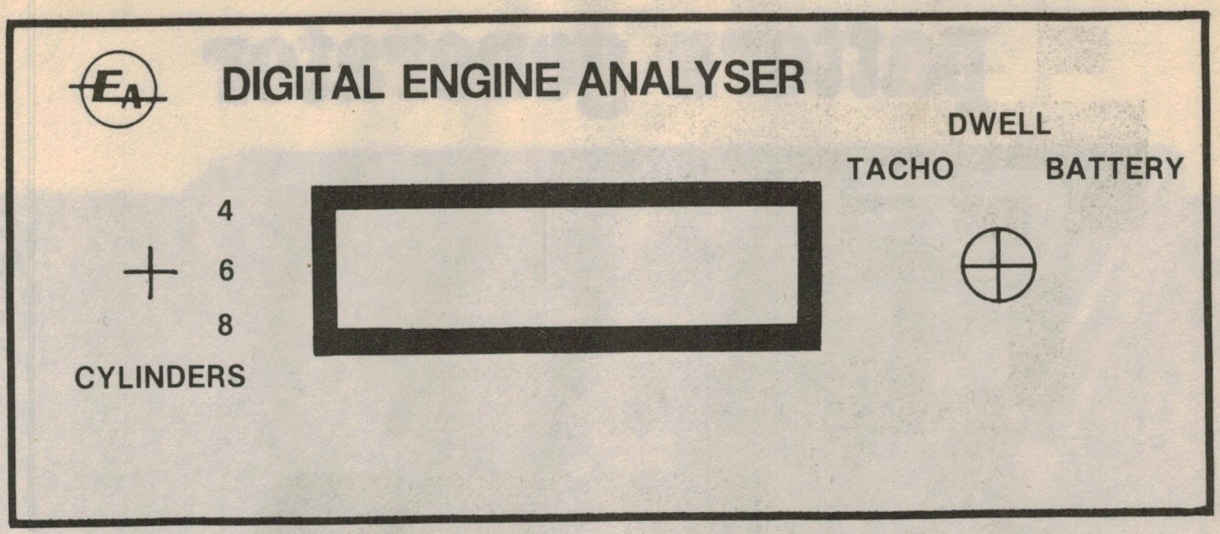

Actual size artwork for the front panel. Finished "Scotchcal" panels should be available from retail outlets.

The use of PC stakes is recommended and any type may be used provided they are a tight fit in the board. These greatly facilitate external wiring connections to the PCB.

Once the two PCBs are complete, they can be soldered together. Let the lower edge of the display PCB overlap the lower surface of the main PCB by about 6mm and make sure that the two are exactly at right angles to each other. First, solder "tack" one strip at either end of the boards together and then temporarily mount the assembly in the chassis to check that the display mates with the front panel cutout. Adjust the two boards as necessary and then solder the remaining connections.

The circuitry is housed in a metal case measuring 184 x 160 x 70mm (D x W x H). Use the front panel artwork to obtain drill centres for the switches, as well as the dimensions of the cutout for the display. With the metalwork complete, mount the PCB assembly using 12mm spacers and then mount the switches and complete the wiring.

Connections to the points and to the battery can be made using alligator clips. Note that the points lead should be rated at 240V in order to achieve acceptable insulation rating. The 10k input resistor should be rated at 1W.

An attractive finish to the engine analyser can be provided by using a "Scotchcal" photosensitive aluminium front panel. Use the artwork provided to make your own panel, or you can purchase a finished panel from the usual retail outlets.

CALIBRATION

Once construction is complete, "fire" up the engine analyser and proceed with the calibration. The tachometer is calibrated by feeding in a half-wave rectified signal from a 6-12V AC transformer (an AC plugpack or soldering iron transformer will do nicely). Simply select the 4-cylinder position, feed in the signal (see Fig. 3), and adjust VR1 for a reading of 1500RPM. Now check the 6 and 8-cylinder ranges – you should get readings of 1000RPM and 750RPM respectively.

The dwell calibration is just as easy. Select the 4-cylinder position once again, short the points lead to 0V, and adjust trimpot VR2 for a reading of 90°. The corresponding readings for the 6-cylinder and 8-cylinder positions are 60° and 45°.

Finally, the battery voltage function should be calibrated against a multimeter or DVM of known accuracy. Hook both instruments up to your car battery and adjust trimpot VR3 to give the correct reading.

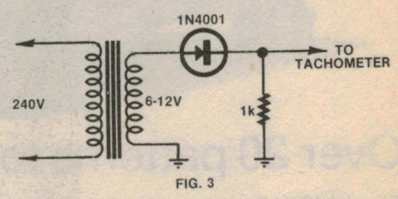

FIG. 3

Use this simple circuit to calibrate the tachometer ranges of the analyser.

That's it – project completed and ready for engine tuning. Drive carefully!

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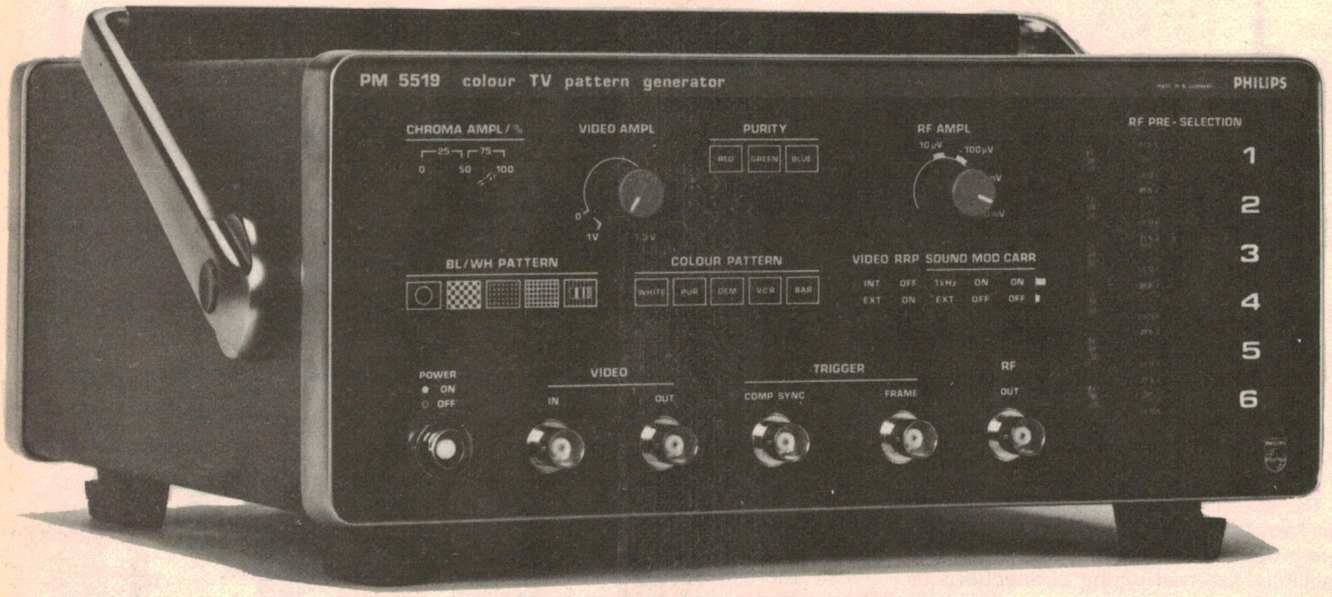

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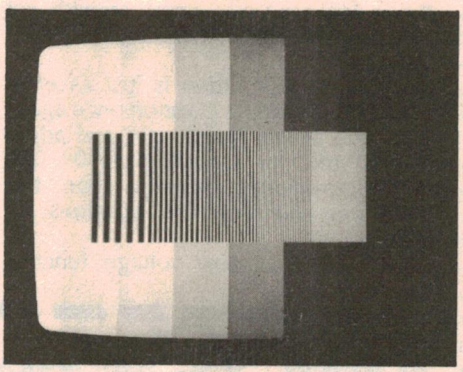

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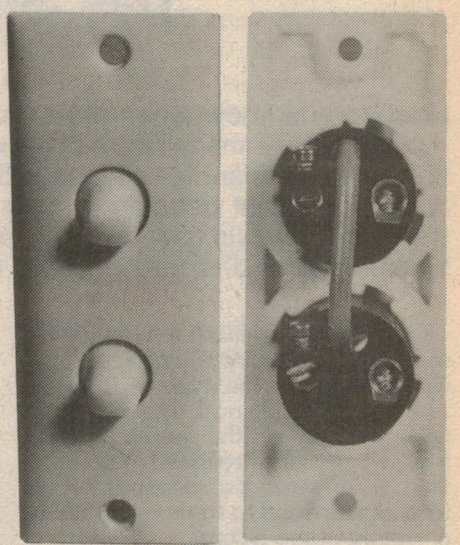
This simple idea gives light dimming with no RFI

Add a Bright/Dim Switch to your lights

Here is a useful idea for those people who wish to dim their room lights on occasion, but do not want to install a fully variable light dimmer. All that is required is a standard dual wall switch and a silicon power diode. Substitute them for the normal light switch, and you can have the lights either bright or dim at will.



There are many occasions in the home when the full brilliance of the room lamps is not required: when watching television, listening to music, dining in an intimate setting, or during parties. Perhaps the most versatile answer to this problem is a wall-mounted variable light dimmer.

Fully variable dimming is not always needed, however. There may also be a problem of radio interference with such dimmers, due to the voltage pulses or "spikes" generated by the phase-controlled Triac circuitry. Operation is usually quite satisfactory in metropolitan areas where the signal from broadcast stations is strong, but real problems can arise in outlaying country areas.

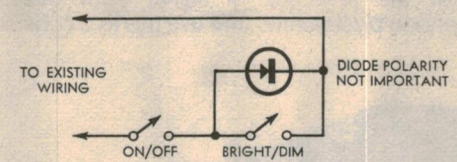
The idea presented here represents a different approach to light dimmers. In principle, a switch is used to connect a semiconductor diode in series with the mains input, so that in the "dim" position, the lamp is fed only with alternative AC half-cyles. This has the effect of considerably reducing the lamp brilliance.

Assuming an AC mains supply of 240 volts, the RMS value of a half-wave rectified sine wave is 170 volts. With typical incandescent lamps which have a very non-linear V-I characteristic, the power input under these conditions is reduced by 25 to 30%, and the brilliance reduced to less than half normal.

Besides simplicity, this arrangement has the advantage that it generates no radio interference. With a conventional dimmer, the Triac switches considerable amounts of power in very short time intervals and it is this which generates the interference spikes. Typically, the Triac switching time is of the order of one microsecond. By contrast, a silicon diode is virtually a "zero-voltage switch" because it begins to conduct heavily with a mere 0.6 volts forward bias. As a result, virtually no interference is generated by this simple dimmer circuit.

On the debit side, there is a tendency for the lamp to flicker. Under normal conditions with a sinusoidal mains input voltage, incandescent lamps are pulsed at 100Hz. The persistence of vision of the human eye and the thermal inertia of the lamp filament conspire to make any flicker unnoticeable. However, when half-wave rectified AC is applied to incandescent lamps, the flicker is at 50Hz and tends to become more noticeable. Just how noticeable the flicker becomes depends on a number of factors. If the lighting is indirect, generally no flicker is apparent. If the observer looks directly at the lamp, flicker may or may not be noticeable, depending on the filament temperature. However, some flicker is usually apparent if the observer looks at the lamp "out of the corner of his eye".

Having installed one of these dimmers in his home, the author has found that



This could be the simplest circuit we have ever published but it works.

the flicker is not irritating and that he is generally quite unaware of it.

The diode used should have a peak inverse voltage (PIV) rating of at least 400 volts. It would be wise, however, to select a diode with a rating of 600 or 800 volts to ensure that it is not damaged by occasional "spikes" and surges which may be superimposed on the mains supply.

An even better idea is to use a "transient protected" diode which will safely withstand most spikes superimposed on the mains by breaking into a "controlled avalanche" discharge. These diodes are made by General Electric and have type number 1N5061 (600 PIV) or 1N5062 (800 PIV). Both diodes have a forward current rating of 2.5 amps.

Two factors must be taken into account when calculating the maximum incandescent lamp load which can be handled by a rectifier. The first is that, due to its severe non-linearity, an incandescent will actually draw more current (on an RMS basis) when connected to a lower voltage than it does when operating at the full rated voltage.

Also related to the non-linearity of the incandescent lamp is the very high surge current at initial switch-on. This must be within the surge capabilities of the diode used.

When both these factors are taken into account, a 1-amp rectifier diode such as a 1N4006 (800 PIV) may be used with incandescent lamp loads up to 220 watts (nominal) while the 2.5 amp transient-protected IN5062 may be used with loads up to 550 watts.

Note that this method of dimming cannot be used with fluorescent lights.

The most convenient way of installing the dimmer is to purchase a dual wall switch. The diode is shunted across the lower switch. A link of insulated wire is connected between the two switches, and the whole assembly is installed in place of the existing light switch. The upper switch is then the main ON/OFF control, and the lower switch BRIGHT/DIM.

Digital stylus timer for hifi systems

has 3 digits & records up to 999 hours

How do you know when the stylus on your cartridge is due to be replaced? How many hours of service has it given? These two questions are important for anyone with a large and valuable record collection but most people can only vaguely estimate how long their stylus has been in use. We have solved that problem with our stylus timer. It keeps a record of stylus use up to 999 hours.

by GERALD COHN

It is really quite difficult to estimate the service life of a typical diamond stylus. It will depend on the type of stylus – whether it is spherical, bi-radial (elliptical) or one of the newer Shibata, Ichikawa or similar refined bi-radial profiles. Stylus wear also depends on the tracking force and to some extent on the condition of the records.

In general, spherical styli have the lowest rate of wear, followed by the Shibata-types of styli. While it would not be unreasonable to expect a life of 1000 hours from a spherical stylus operating at 1.5 grams tracking force, considerably lower figures could be expected from other styli, especially if they are operated at two grams or more. It is best to play safe and have the stylus inspected at after 300 to 400 hours and at shorter intervals after that. Once the stylus starts to develop flattened "shoulders" record wear and deterioration proceeds rapidly.

So for the sake of your record collection, you really should have some means of keeping tabs on the service hours of your stylus. Some enthusiastic souls make use of a manual counter and clock it on after each hour of use. For those of us with human foibles this method is just not practical. Far better to have a device which keeps a count of hours while ever the turntable is in use. Our timer does just that.

It is connected in parallel with the turntable mains supply and advances the count while ever the turntable motor is running. There are other ways of achieving this. You could, for example, monitor for the presence of signal from the phono preamplifier and use this as a control for advancing the counter stages. If this method was used, great care would have to be taken to avoid injection of digital "hash" into the audio system. But we're getting ahead of ourselves . . .

We opted for a simple scheme which did not involve any connections to the audio signal system. By sensing the presence of AC power at the turntable motor, the timer is enabled and powered at the same time. Standby batteries maintain the count while the turntable or the whole system is turned off. In this way, it is possible to avoid using the hifi system for months at a time and still have an accurate record of stylus service hours.

The same system could be employed to keep a record of service hours for any other piece of mains powered equipment.

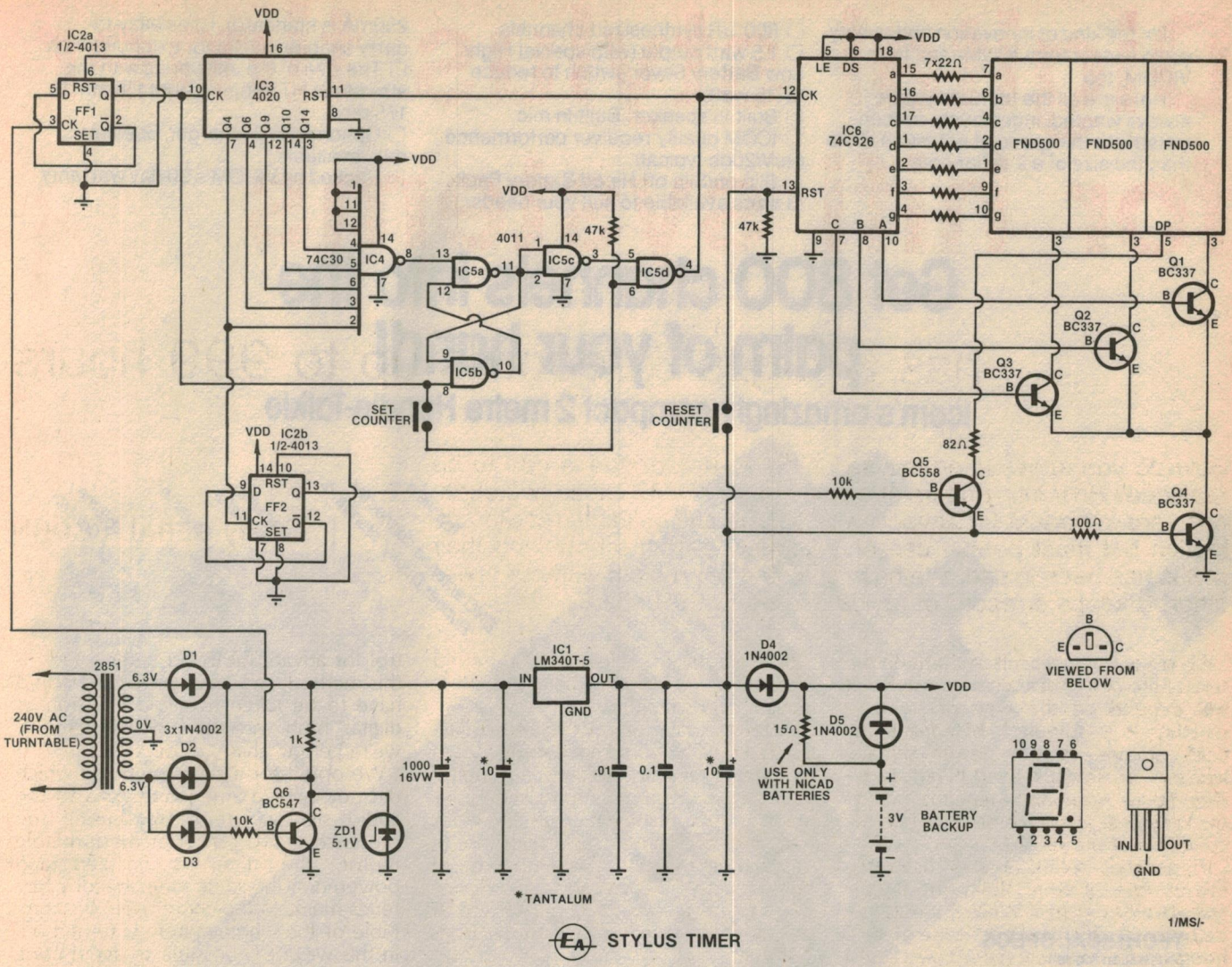
The stylus timer counts the number of hours that the turntable is in use. Standby batteries maintain the count while the turntable is turned off.

HOW IT WORKS

The circuit is quite straightforward and uses six integrated circuits, five transistors and a few other parts. The action begins at the power supply part of the circuit. A small transformer feeds a full-wave rectifier, D1 and D2 and thence a 1000uF capacitor which supplies a three-terminal 5V regulator, IC1.

Diode D3 feeds half-wave rectified 50Hz to transistor Q6 which has a 5.1 volt zener diode connected to its collector. This produces a 50Hz square wave signal suitable for feeding into the following counter circuitry. The first stage of division takes place in flipflop IC2a. From there, the signal is fed to a 14-stage ripple counter, IC3, which has an eight-input NAND gate, IC4, connected to it to decode state 18000.

The output of NAND gate IC4 is a negative going pulse, lasting half a clock-period which sets the RS flipflop consisting of IC5a and IC5b. The output of



A 4013 dual flipflop, a 4020 14-stage binary ripple counter, and a 74C926 4-decade counter form the heart of the circuit.

IC5a then goes high and low again as the flipflop is reset by the negative-going half of the clock signal. The output of IC5a is thus high for only half a clock period, and is used to reset the 4020 via IC5c and IC5d.

Since the reset pulse is only half a clock period long, the most significant output of the 4020 (Q14) is only high for one half a clock period. As a result, we find that the effective division of the 4020 is only 9000 despite the fact that the binary division ratio is 18000. It is for this reason that we have added a divide by two flipflop before the 4020, therefore providing us with an overall count of 18000.

Thus, when combined with flipflop IC2a, IC3 gives a total division of the 50Hz input of 18000. This means that the following 74C926 four-digit counter, IC6, is fed with one pulse every six minutes.

Note that the reset pulse applied to the reset input (pin 11) of the 4020 is also used as the clock pulse for the 74C926 (IC6).

Since only three digits are required to indicate a reading up to 1000 hours (or 999, in this case) the first decade counter in the 74C926 is not used to drive a digit. Instead, it just provides another decade of division, necessary in order to provide one pulse per hour to what is really a three-digit hour counter.

To enable the three-digit counter to be reset (which is necessary when a new diamond stylus is installed in your cartridge), a pushbutton is provided on the rear of the case. This connects the reset pin of IC6 to the five-volt line, which resets all four internal decade counters. Resetting can only take place when mains power is applied, not when the unit is on battery standby.

Presetting the counter is also possible, via another pushbutton on the rear of the case. As with digital clocks, presetting means that the counters are sped up markedly so that you don't have to stand around for three days. In this case, the 25Hz signal from IC2a is used to drive the 74C926 directly via IC5d. This enables any value from 000 to 999 to be quickly preset, with the display being incremented at a 2.5Hz rate.

Since the three digit display is multiplexed, all segment lines are connected in parallel while each digit has a separate driver transistor, Q1, Q2 or Q3. FND500 common-cathode displays are used, as they give a bright display with an integral red filter and they are low in cost.

The decimal point of the least significant digit flashes at a rate of 0.78Hz. This lets you know the device is working and not just sitting there like a "shag on a rock".

Q5 and IC2b provide this "activity indicator". Flipflop IC2b divides down the Q4 output of IC3, which runs at 1.56Hz. The divided output is then fed to transistor Q5 via a 10k resistor. Q5 drives the decimal point anode of the last digit.

When the mains power is turned off, the recorded "count" of the circuit must be maintained. This is achieved by a battery backup circuit which can use

We estimate that the cost of parts for this project is approximately

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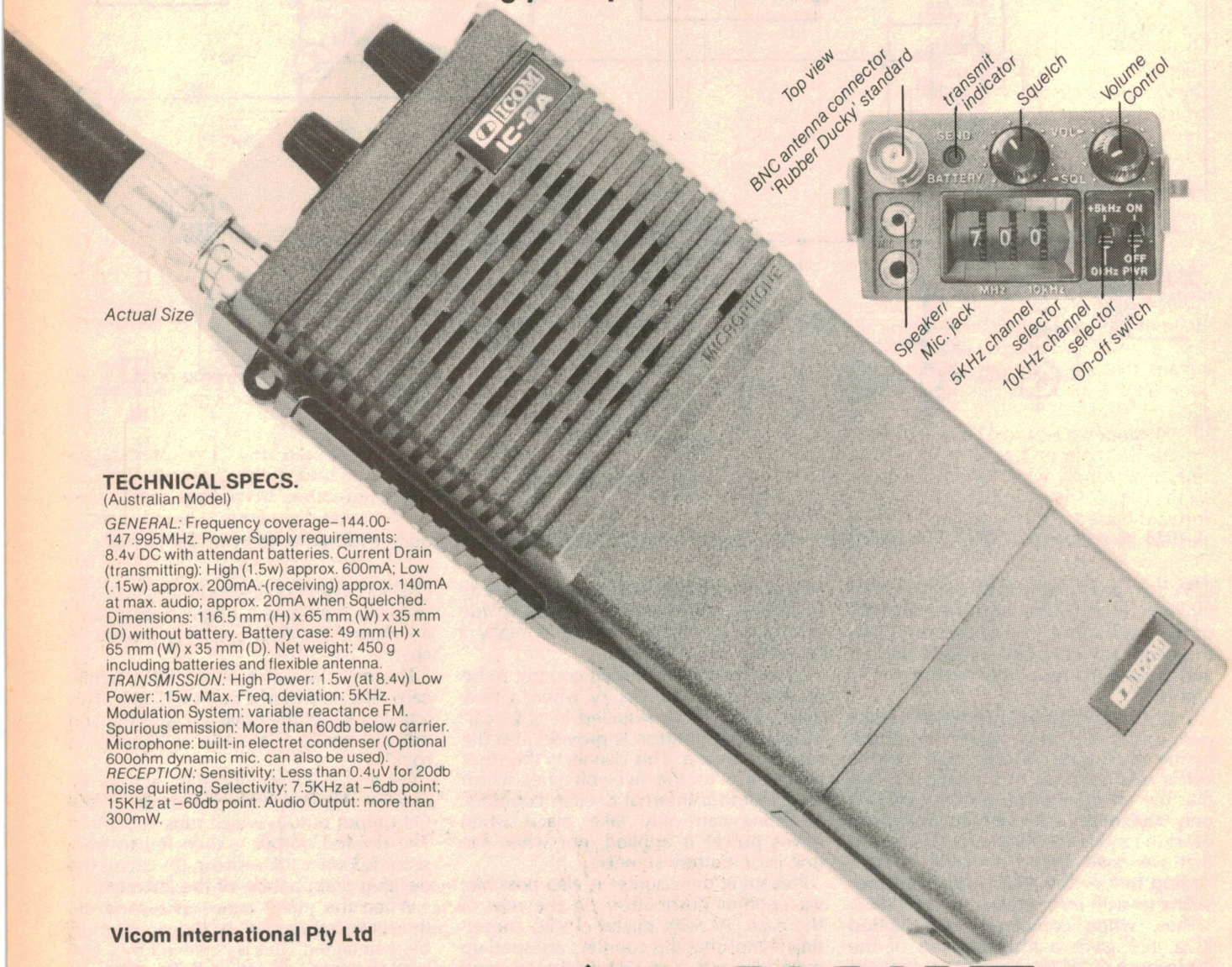

Actual Size

TECHNICAL SPECS.

(Australian Model)

GENERAL: Frequency coverage–144.00-147.995MHz. Power Supply requirements: 8.4v DC with attendant batteries. Current Drain (transmitting): High (1.5w) approx. 600mA; Low (.15w) approx. 200mA.-(receiving) approx. 140mA at max. audio; approx. 20mA when Squelched. Dimensions: 116.5 mm (H) x 65 mm (W) x 35 mm (D) without battery. Battery case: 49 mm (H) x 65 mm (W) x 35 mm (D). Net weight: 450 g including batteries and flexible antenna.
TRANSMISSION: High Power: 1.5w (at 8.4v) Low Power: .15w. Max. Freq. deviation: 5KHz. Modulation System: variable reactance FM. Spurious emission: More than 60db below carrier. Microphone: built-in electret condenser (Optional 600ohm dynamic mic. can also be used).
RECEPTION: Sensitivity: Less than 0.4uV for 20db noise quieting. Selectivity: 7.5KHz at –6db point; 15KHz at –60db point. Audio Output: more than 300mW.

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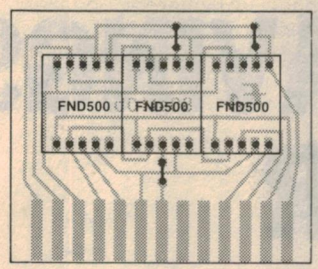
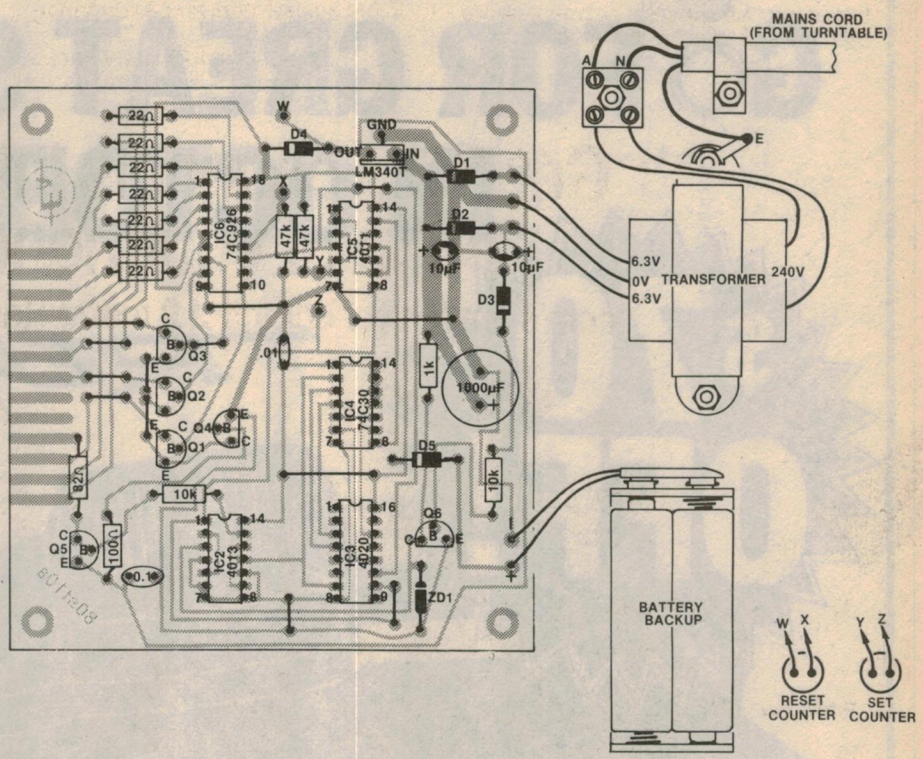


The display board is easy to build. Don't forget the three wire links.



Follow this overlay diagram in conjunction with the circuit when wiring up the Stylus Timer. Note the orientation of Q4 with respect to adjacent transistors.

alkaline cells or nickel-cadmium cells. To keep the battery current drain very low, the three-digit display is disabled via Q4, which is connected to the emitters of the three cathode-driver transistors, Q1, Q2 and Q3.

Whenever the mains supply is present, Q4 is able to conduct by virtue of the 100 ohm base resistor connected to the 5V supply. The 5V supply drops to zero, when the mains goes off, and Q4 turns off and extinguishes the display.

When the display is off, the current drain of the rest of the circuit is typically just a few microamps or so, which means that the batteries should last a long time – or effectively, their "shelf" life.

Two diodes, D4 and D5, are used to isolate the battery supply from the 5V regulated supply when the mains is on. With the 5V supply present, D4 is forward-biased, allowing current to flow through to the circuit. At the same time, D5 is reversed-biased, by virtue of the fact that the voltage at the junction of the two diodes is higher than the battery voltage.

If alkaline cells are used, only two are required, giving a nominal battery voltage of 3.0 volts. If nickel-cadmium cells are used, three will be required, giving a nominal voltage of 3.6 volts and D5 may be replaced by a 22 ohm resistor to give a charging current suitable for 450 millamp-hour cells (ie, penlites).

CONSTRUCTION

So much for the operation of the circuit. Let us now take a look at the construction and presentation of the unit.

We have designed a printed circuit board (PCB) which measures 110 x 113mm and is coded 80st10a for the main part of the circuit, and a second PCB measuring 58 x 48mm (80st10b) for the displays. The boards are mounted at right angles to each other with the display board soldered directly to the main one.

Construction is straightforward and should only take a few hours or so. The best starting point would be to place the links on the board and solder these into place. Follow these up with the resistors and the capacitors, and then finally the diodes and the transistors. The last items to go on the board are the ICs. They are all CMOS types and should therefore be handled with the usual precautions being taken.

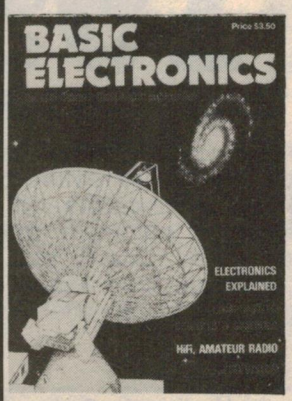
We recommend the use of PC pins for all the external connections such as the transformer, the pushbuttons and the battery standby supply.

The display board is simple to assemble requiring only three links and the displays to be soldered to it. Make sure that you do not install the displays upside down.

The next step now is to prepare the case that is to house the unit. The case we used came from Dick Smith Electronics and measures 186mm deep x 160mm wide x 70mm high.

We have prepared a front panel artwork for this case which was made using the "Scotchcal" process. The cutout for the three displays measures 46 x 17mm and is the only hole required in the front panel. The set and reset pushbuttons are mounted on the rear panel of the unit.

Once the chassis of the case has been suitably prepared, all that remains to be done is to mount the electronics into it. The display board is first held in place on



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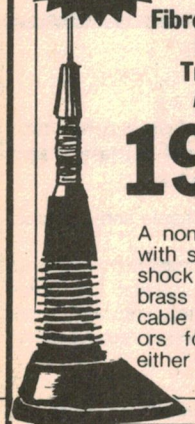

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the front panel by the displays, which are pushed through the cutout. The main board is then fitted with four 15mm threaded spacers and butted up against the display board to find the level at which it is to be soldered. We suggest that when you have found the correct level you mark it with pencil line so that you have a reference to work against during soldering.

It is important when soldering the two boards together to make sure that they are perpendicular to one another. This is best achieved by first soldering the two outermost connections and then with the aid of the soldering iron, make any adjustments that may be required. When the geometry of the assembly is correct, go ahead and solder the remaining connections.

Now, place the completed assembly back into the case and allow approximately three millimetres of the display bodies to protrude through the front panel. Using a pencil or some other suitable instrument, mark out the locations of the four holes that hold the assembly in place. Drill the holes to the required clearance size for the screws used but don't fasten the PCBs into place yet.

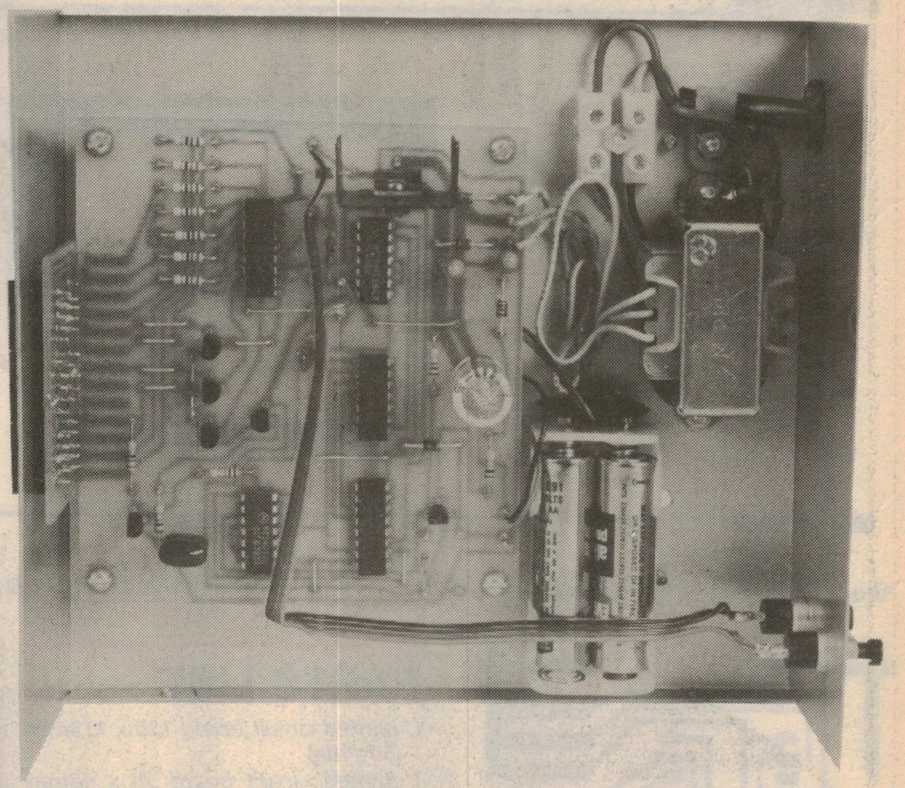
Now place the transformer and the terminal block into place and mark out their mounting holes. Drill these out and then mount the transformer and the terminal block into place. Feed the mains cable into the chassis via a suitably grommeted hole.

The next step is to anchor the mains cable with the retaining clip and to terminate it into the terminal block. The earth wire is connected onto the body of the transformer using a solder lug that is placed under one of the nuts holding the transformer in place.

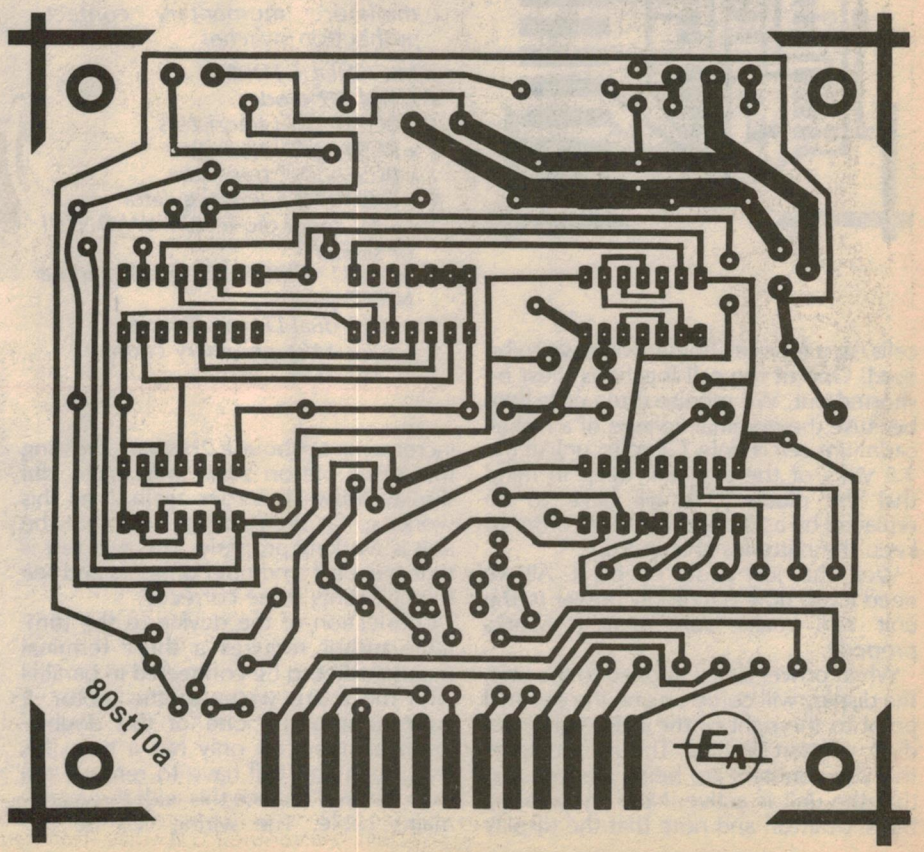
Mount the set and reset pushbutton switches on the rear panel as shown in the wiring diagram. Having done this, mount the PCB assembly into the chassis and start wiring the transformer and the pushbuttons to the board.

The battery standby supply can now be placed into the chassis. Since we only require two cells (in the case of dry cell backup) we will also need a holder for these. These are available with the connection to them being made with a clip, this being the same clip as the one required for the miniature nine volt battery. The battery holder in the prototype unit was held in place with double sided tape, but a bracket fashioned from a scrap of sheet metal will do just as well.

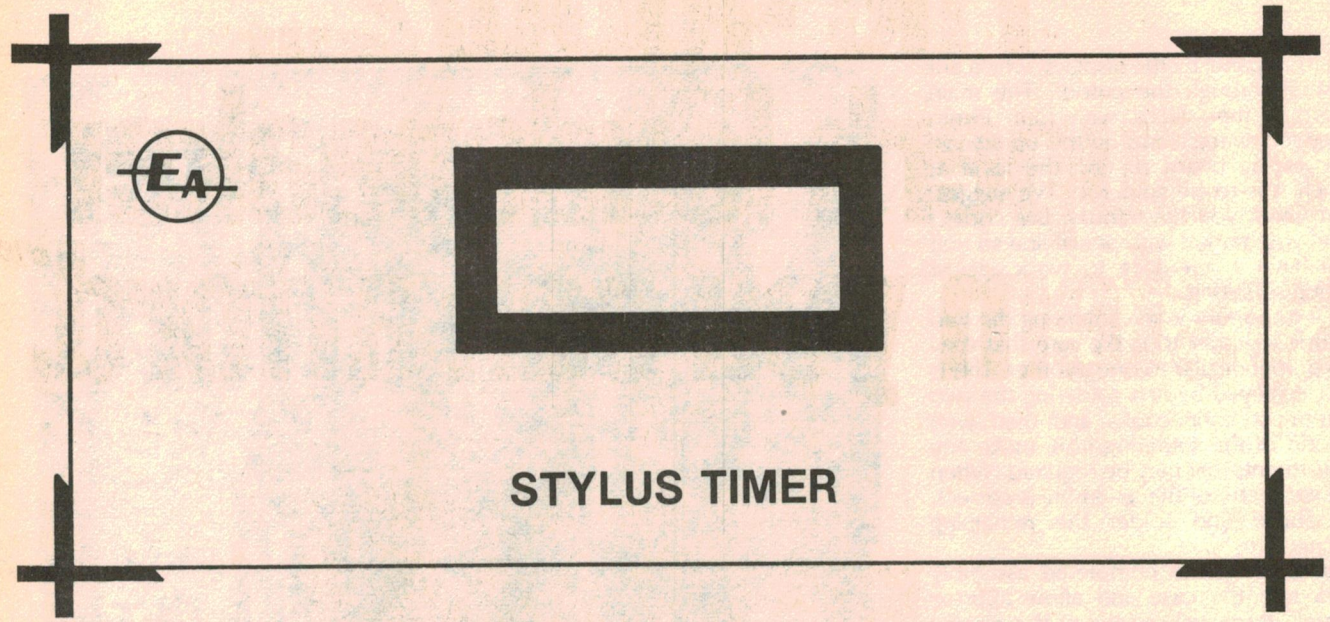
If you elect to use nickel-cadmium batteries, then you will require a larger battery holder, capable of holding at least three batteries. It is quite difficult (if not impossible) to obtain holders for three



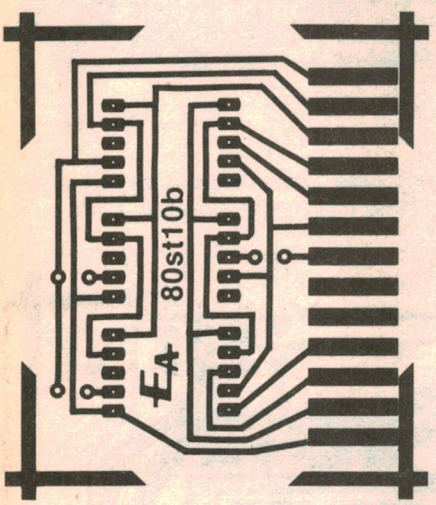
Above is an inside view of the completed prototype, while below is an actual size reproduction of the PCB artwork. Be sure to keep mains wiring neat and tidy.



FRONT PANEL ARTWORK



Above and below are actual size artworks for the front panel and the display PCB.



PARTS LIST

1 printed circuit board 110 x 113mm (80st10a)
1 printed circuit board 58 x 48mm (80st10b)
1 transformer, type 2851 240V to 12.6V c.t.
1 terminal block, two-way
2 miniature momentary contact pushbutton switches

SEMICONDUCTORS
5 x 1N4002 diodes
4 x BC337 NPN transistors
1 x BC547 NPN transistor
1 x BC558 PNP transistor
1 x LM340T-5 5 volt regulator
1 x 5.1V zener diode 400mW (1N751 or similar
1 x 4011 CMOS IC quad 2-input NAND gate
1 x 4013 dual D-type flipflop
1 x 4020 14-stage binary counter
1 x 74C926 4-decade counter/display driver
1 x 74C30 8-input NAND gate
3 x FND500 common-cathode seven-segment displays

CAPACITORS
1 x 1000uF 16VW electrolytic (PC type)
2 x 10uF 25VW tantalum electrolytic
1 x 0.1uF metallised polyester
1 x .01uF metallised polyester

RESISTORS (¼ or ½W, 5% tolerance)
2 x 47k, 2 x 10k, 1 x 1k, 1 x 100 ohm, 1 x 82 ohm, 7 x 22 ohm, 1 x 15 ohm (see circuit)

MISCELLANEOUS
1 x battery holder to suit 3 AA-size nickel-cadmium cells or two alkaline cells
1 x clip to suit battery holder

cells, so a four cell holder will have to be used. One of the cell locations must be shorted out. We require three cells here because the nominal voltage of a nickel-cadmium cell is only 1.2 volts, unlike the 1.5 volts of the dry cell. Keep in mind that the diode (D5) will have to be replaced by a 22 ohm resistor in order to keep the batteries charged up.

Well, that just about covers it. All we need to do now is to apply power to the unit and make sure that it works properly.

When power is first applied to the unit, the display will come on and the decimal point to the right of the least significant digit will start flashing. This is to indicate that the counters are being clocked and that the unit is active. Now try pressing the set button and note that the display increments at about a 2Hz rate. Pressing the reset button now will make the display show all zeroes again. If all this works so far then chances are that the unit is working properly. The acid test is to leave it for a number of hours and see that it counts these correctly.

Connection of the device to the turntable motor requires a three terminal mains socket to be connected in parallel with the mains wiring to the motor. If your turntable is one of the double-insulated types or only has a twin flex lead, then you will have to remove the twin flex and replace this with three core mains cable. The wiring can be terminated in the turntable base using a three-way terminal block.

The mains socket can be either a panel mounting type or, if you prefer, an extension lead type. If the turntable is a double-insulated type then you will only need the earth wire for the timer. The terminal block is just used as a transition connector in this case. The earth wire is most important since the Stylus Timer has a metal case.

There you have it! A unit that will keep track of the number of hours that the stylus has been working for, and as such it should prove a valuable piece of equipment to all audio enthusiasts.

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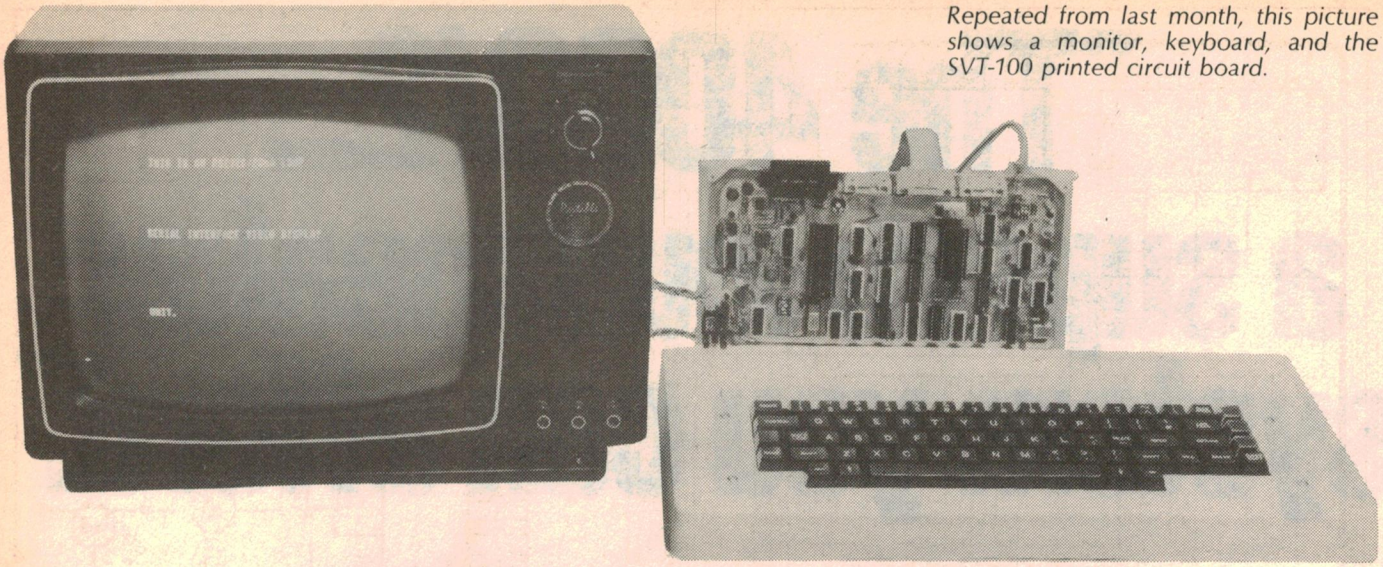


Repeated from last month, this picture shows a monitor, keyboard, and the SVT-100 printed circuit board.

SVT-100 serial video terminal Part 2

In this second and final article on the SVT-100 serial video terminal, we continue details of the circuit description, publish the full circuit diagrams and provide brief constructional information.

by RON KOENIG

The visual display circuit consists of a video page memory, character generator, video combiner and the CRT controller. These modules produce a VDU unit which is capable of storing, decoding and formatting a page of 1024 ASCII characters for display on a cathode ray tube (CRT).

This VDU employs a single-chip CRT controller (CRT 96364) to provide all the necessary control functions for cursor movement, memory writing and reading, control of the character generator and the generation of the vertical and horizontal sync pulses. The controller requires a 1.008MHz clock to generate the CCIR standard sync signal, and a 3-bit code to determine the required function. A low-cost PROM, IC12 decodes this 3-bit code from the 8-bit incoming data from the UART. The 1.008MHz clock is derived by a divide-by-12 counter, IC27, operating from the 12.096MHz crystal controlled dot clock (IC28a, b and c).

The page memory consists of a pair of 2114 static RAMs, IC17,19, providing a total memory of 1Kx8 bits. As these RAM's have a bidirectional data bus, a pair of Tristate octal buffers, IC16, IC18, are used to produce a separate 8-bit "data-in" and "'data-out" bus.

The data coming from the receive section of the UART is gated through a pair of quad 2-input multiplexers, IC14, IC15, before being presented to the data-in bus. These multiplexers provide the CRT controller with a means of forcing the "space" code ("20"H) onto the data-in bus when it is performing a line or screen erasure. The data present on the data-in bus is written into the RAM only during the horizontal retrace and the data strobe, received with the data from the UART, initiates the RAM write command. During the next horizontal retrace the CRT controller sets the RAM address to the address of the cursor and strobes the RAM R/W line low. Immediately following the write command the RAM addresses revert to refresh addressing and the cursor is shifted one character.

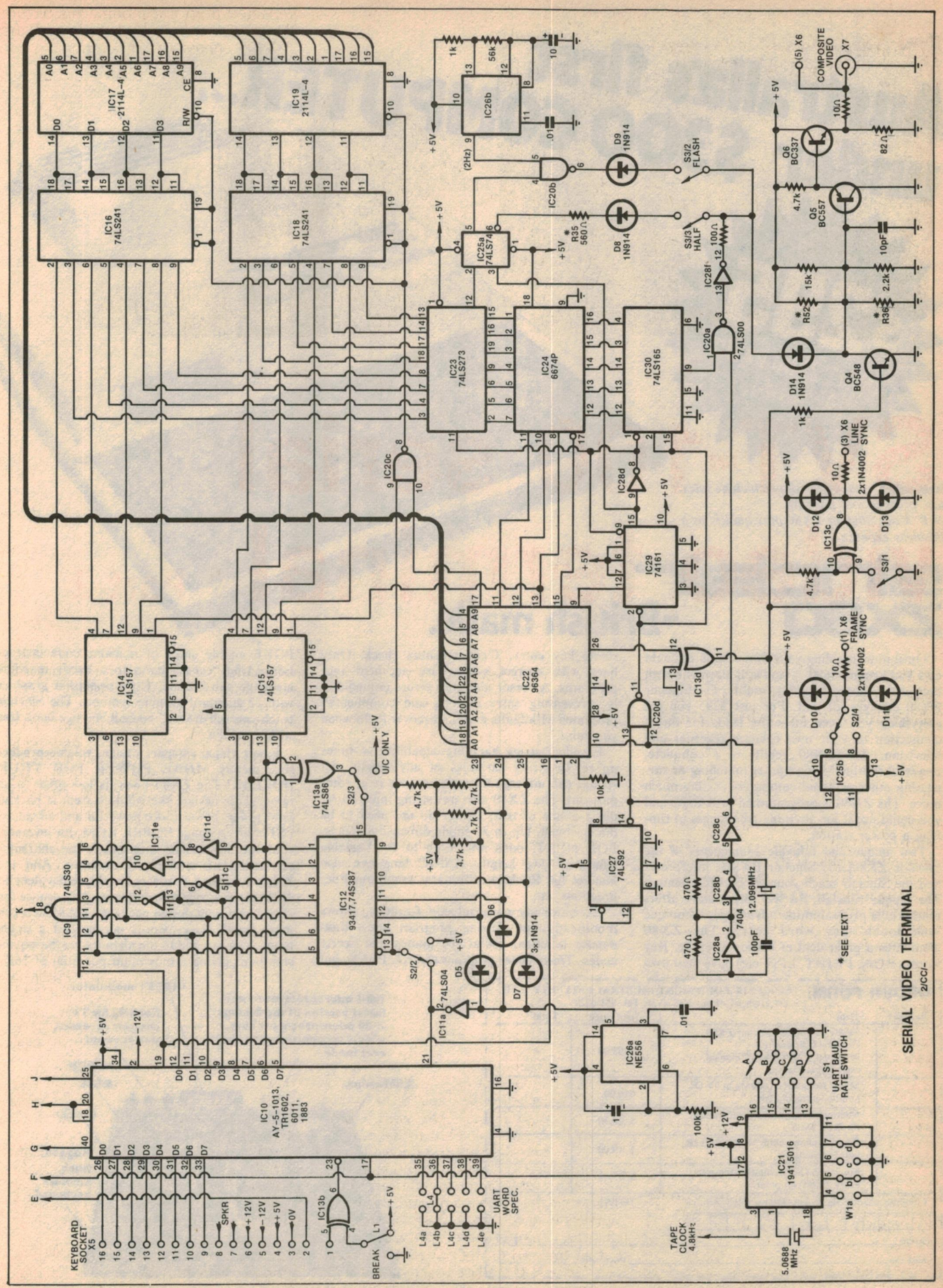
If, at the end of the horizontal retrace the cursor is as the last position on a line, a carriage return and line feed will automatically occur. When the cursor is at the last position of the last line, a carriage return and up-scroll will automatically occur. Scrolling will result in the entire top line of the screen being erased and all of the remaining lines shifting up. Scrolling of the text will also occur if a line feed command happens when the cursor is at the bottom line of the screen.

Full cursor control is effected on this terminal by 10 non-printing control codes which are decoded by the 256x4 bit PROM, IC12. This PROM generates a 3-bit code for every ASCII character received by the terminal for use as the CRTC command inputs C0, C1 and C3.

The fourth bit of the decoder PROM is used as a write enable signal (at IC20c), and will inhibit RAM "write" when one of 8 of the 11 control codes is received. In the same manner, display of the lowercase is inhibited if S2-2 is set.

During refresh addressing the CRT controller scans the video memory once every 20ms and processes the ASCII code stored there into a form suitable for display on a CRT. This is achieved with the aid of the octal latch IC23, the character generator IC24 and a shift register IC30. The 7-bit ASCII code latched in IC23 is presented sequentially to

Most of the circuit is shown on the page opposite with the rest shown on page 69.


IC17 2114L-4
IC19 2114L-4
IC16 74LS241
IC18 74LS241
IC26b
IC25a 74LS74
IC23 74LS273
IC24 6674P
IC30 74LS165
IC29 74161
IC22 96364
IC14 74LS157
IC15 74LS157
IC12 93417,74S387
IC27 74LS92
IC10 AY-5-1013, TR1602, 6011, 1883
IC26a NE556
IC21 1941,5016
IC9 74LS30
IC13a 74LS86
IC11a 74LS04
IC13b
IC13c
IC13d
IC25b
IC28a 7404
IC28b
IC28c
IC28d
IC28f
IC20a 74LS00
IC20b
IC20c
IC20d
IC11a
IC11c
IC11d
IC11e
D5
D6
D7
D8 1N914
D9 1N914
D10
D11
D12
D13
D14 1N914
Q4 BC548
Q5 BC557
Q6 BC337
R35 560Ω
R52 15k
R36 2.2k
10pF
82Ω
10Ω
4.7k
470Ω
100pF
12.096MHz
3x1N914
2x1N4002
(1) X6 FRAME SYNC
(3) X6 LINE SYNC
(5) X6 COMPOSITE VIDEO
X7
S3/2 FLASH
S3/3 HALF
S3/1
S2/2
S2/3
S2/4
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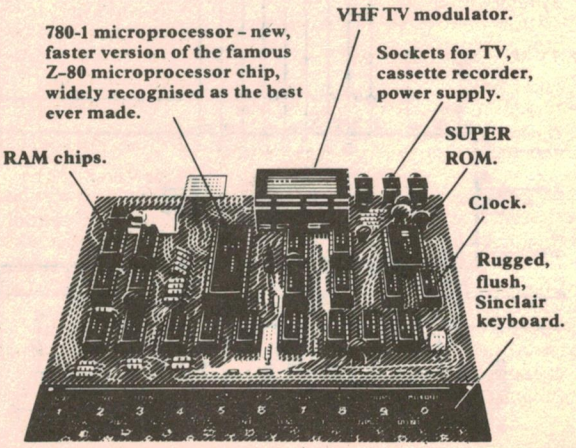

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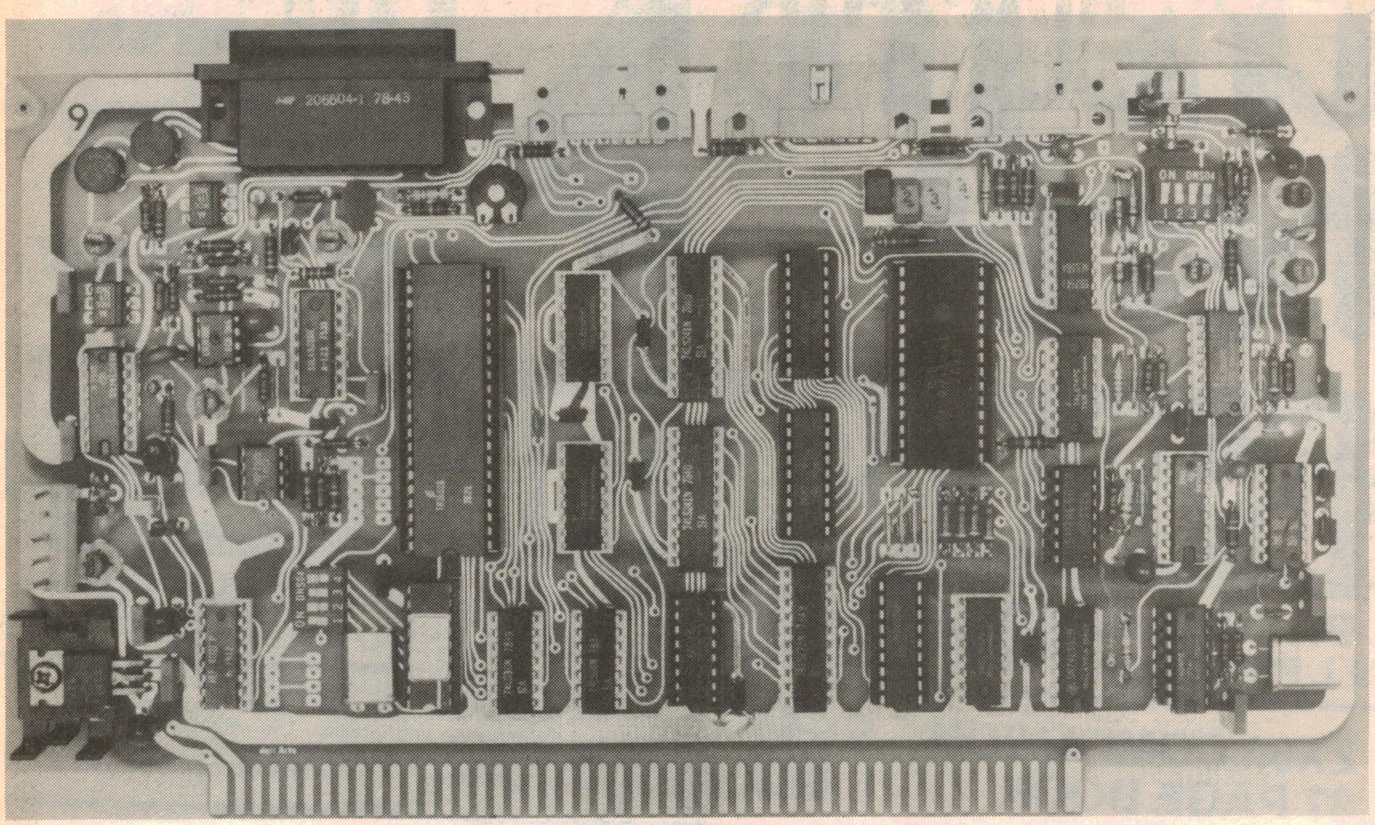

A view of the finished prototype PCB. PCB's supplied to constructors will be silk-screened with the component overlay and will have a solder mask on both sides. We recommend the use of sockets for the ICs.

the character generator together with a 3-bit row address code from the CRTC. The 5-bit output from the character generator is serialised by the shift register to provide the basic video signal.

The shift register requires a parallel load and clock pulse to synchronise the serialising of the character bit-pattern being supplied by the character generator with the video line and frame sync pulses being generated by the CRTC. The binary counter IC29 and gates IC20d and IC28d provide this function, however since all displayed characters must be positioned directly beneath each other we also need a signal at the start of each scanned line to synchronise the binary counter. The CRTC provides this signal from pin 10 as the Dot Clock Enable (DCE). The CRTC sends DCE high 11*us* after the horizontal sync pulse and IC20d gates the dot clock to the divide-by-eight binary counter and to the clock input of the shift register.

The binary counter produces two output pulses. One, the Display Character Clock (DCC) pulses, is generated at the end of each eight dot clocks and used by the CRTC to increment its internal memory address counter. The other pulse is the binary counter's Terminal Count (TC) pulse. The leading edge of TC is used to latch the character attribute bit into IC25a and to "parallel load" the shift register. The trailing edge of TC latches the new ASCII character being addressed by the CRTC into the character latch IC23 and presets the binary counter back to count eight. This process of loading the shift register with the present character's dot pattern, advancing the CRTC address to the next character address, latching the next character and presenting it to the character generator for decoding, and resetting the binary counter is repeated until the end of the 64th character. The CRTC then inhibits the dot clock at IC28c until the following line scan commences. To generate the required display the above sequence is repeated eight times for each of 16 rows of 64 characters while the CRTC supplies the appropriate "row address" on its C0, C1 and C2 lines to the character generator.

The vertical spacing of half a character line between each character line is generated by the CRTC. It blanks the video signal for a period of four line scans by holding the row address for the character generator at "000". The horizontal spacing between the characters is provided by the shift register. Since IC30 is an eight-bit shift register and the character generator's output is only five bits, each character can be preceded by two unmodulated (blank) dot columns, and followed by one. There is therefore a space three dots wide between each character.

The video signal is then combined with sync pulses to produce the composite video signal required by most video monitors. A resistive divider has been used to set the amplitude of the composite video signal and transistors Q5 and Q6 provide a low output impedance video buffer. This composite video signal is made available at the co-ax connector X7. The separate line and frame sync TTL level signals and the video signal is available at X6 for direct drive video monitors.

The selected video attribute of "half-intensity" or "flashing" character is provided by the eighth bit of the received data word. This bit is set to a logic 1 by the main computer under program control whenever the attribute for a particular character is required. Bit eight is stored and read from the video memory with the other seven bits, and during refresh addressing it is latched by IC23 and made available to the attribute processing circuitry IC25a, IC20b and IC26b. When switch S3-3 has been closed the half-intensity attribute is selected and, when bit eight is a logic 1, R35 divides down the video amplitude. When S3-2 is closed the flashing character attribute is selected and IC20b inhibits the selected character video amplitude at an approximate 2Hz rate. The astable IC26b is the 2Hz oscillator and the latch IC25a delays the attribute bit by one character time to

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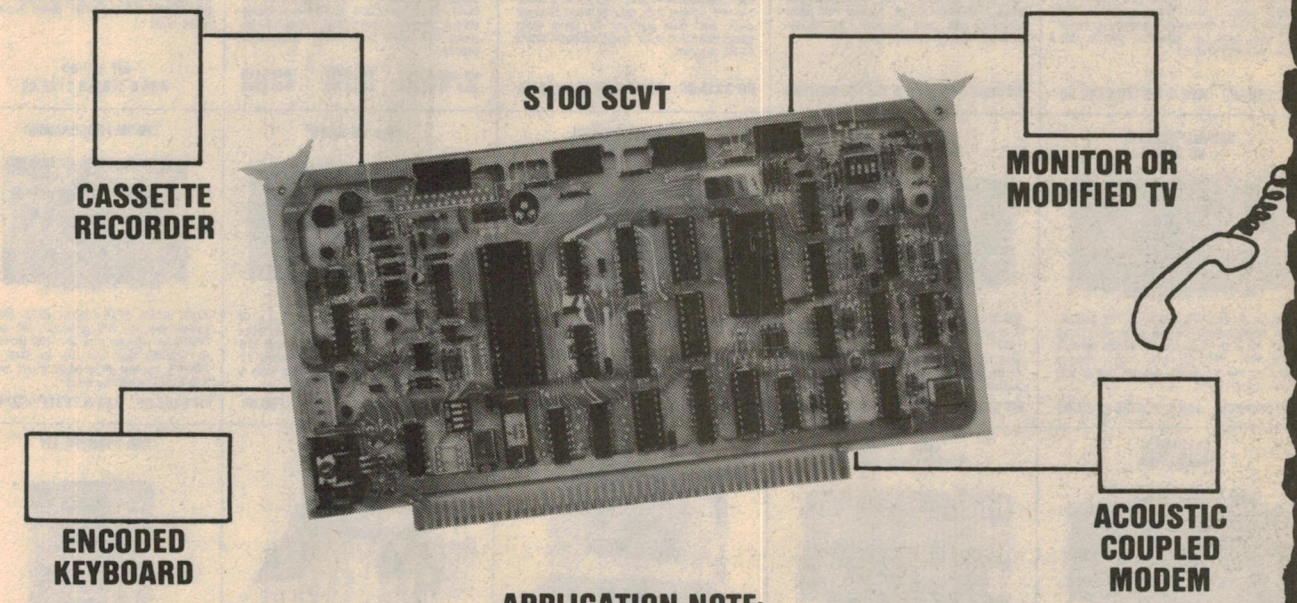

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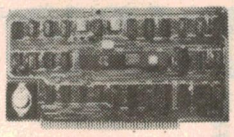
KIT $360.00 ASS & TESTED $440.00

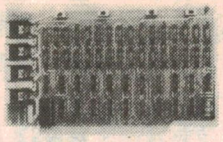
MPB100



Z80 CPU board, switchable 2 or 4 MHz operation, power on jump to any 4K boundary, on board 2716 PROM socket, optional front panel provision, wait state generator, 2K monitor available, will suit dynamic rams.

Kit $260.00 ASS & TESTED $310.00

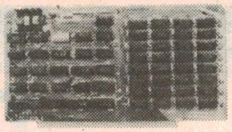
16K STATIC RAM



2114 low power RAM chips, 4K address boundary, standard bank select (40H) 4 MHz operation with no wait state required when using our chips, wait state generator for above 4MHz plated thru holes, solder resist, opotional 300nS RAMS available,

KIT $315.00 ASS & TESTED $380.00

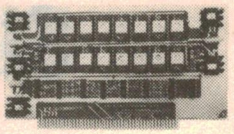
32-64K DYNAMIC RAM



Bank select, 200 nS chips standard up to 4MHz speed, will accept 64K rams to give 256K per board, switch selectable boundaries, invisible refresh, phantom output disable, standard S100, plated thru holes, solder resist, components overlay.

KIT 32K-$525 48K-$670 64K-$815
A&T 32K-$605 48K-$750 64K-$895

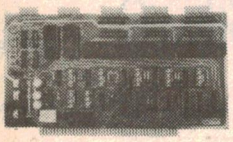
2708 EPROM



Switch selectable as 8 or 16K card 8K address boundary, wait state gen. suites industry standard 2708's standard S100, plated thru holes, solder resist.

KIT $98.00
ASS & TESTED $125.00

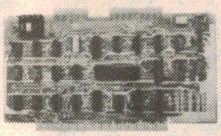
SERIAL-PARALLEL I/O PORT



Dual serial ports with RS232 & TTY outputs, nine programmable parallel ports, wire wrap cross link area for parallel I/O, switch selected baud rates, 9600-75 baud, 4 byte address decoding for I/O, switch selected, plated thru holes, solder resist.

KIT $189.00 ASS & TESTED $225.00

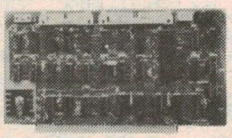
SINGLE DENSITY DISK CONTROLLER



IBM 3740 soft sectored, operates standard 8' or 5' drives, single or double sided drives, utilizes FD1771 controller chip, runs CP/M disk opp software, operates with Z80, 8085 & 8080 CPU, CP/M, BIOS & diagnostic proms to suit are available.

KIT $258.00 ASS & TESTED $308.00

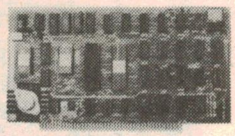
SINGLE/DOUBLE DEN. DISK CONTROLLER



Operates with single & double den. single & double sided drives & 8' or 5' drives in any combination of 4 drives simultaneously, phase lock loop data recovery, with SDOS operating system you can run all CP/M and CDOS programmes.

KIT $360.00 ASS & TESTED $420.00

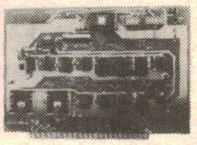
80 x 24 VIDEO



On board Z80, 80 char. x 24 lines, 7 x 10 matrix, keyboard interface, 96 up & lower character, 32 special characters, optional 128 extra char composite video, for/rev scrolling, XY address cur, blinking underline reverse video & field protect.

KIT $380.00 ASS & TESTED $450.00

EPROM PROGRAMMER



2708, 2758, 2716, 2516, 2732 EPROMS switch selected, 26V generator, ZIF socket, CP/M driver program, max, time 100 sec for 16K bit EPROMS mod. available for TMS 2716 EPROMS, optional PROM based driver routines STD S100, plated thru holes.

KIT $205.00 ASS & TESTED $255.00

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True active termination, fuse proct supply rails to extention socket, numbered test points, reset line (75) not terminated, solder resist, plated thru holes, standard S100 D.I.L. resistor packs, this board is a must for reliable operation.

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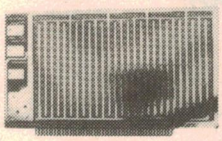

Now with plated thru holes, GND & supply rails on both sides, +5V +12V & −12V regulator provision, Hole array is .1 × .3 to suit all IC package sizes, provision for filter bypass caps, 5V reg is TO3.

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Onboard keyboard & HEX display, Kansas City cassette, PROM programmer S100 interface, 2K RAM, 4K PROM, 2K optional, 2K monitor, CTC timer, interrups, 2x8 bit ports, wire wrap area, 120 page manual, single 5V supply, single step, breakpoints.

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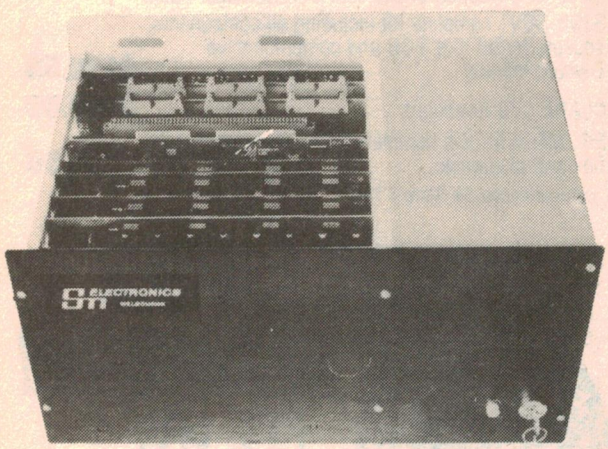
S-100 & 6800 CHASSIS



11 slot backplane, fully card guided. 15 amp power supply, fan, key switch, bench mount, rack mount, annodised aluminium. 5 edge connectors standard. S-100 Bench Kit **$345.** S-100 Rack Kit **$306.** 6800 Bench Kit **$370.00.** 6800 Rack Kit **$330.** Assembled prices add **$100.**

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SME SYSTEMS

offset the delay produced by the shift register.

The control code "Bell" is decoded by gate IC9 and triggers the gated-burst oscillator IC8. The burst of audio tone produced is wired to both the Keyboard connector (X5) and the direct drive video connector (X6). This tone can be used to drive a piezo-electric buzzer or small speaker located at either unit.

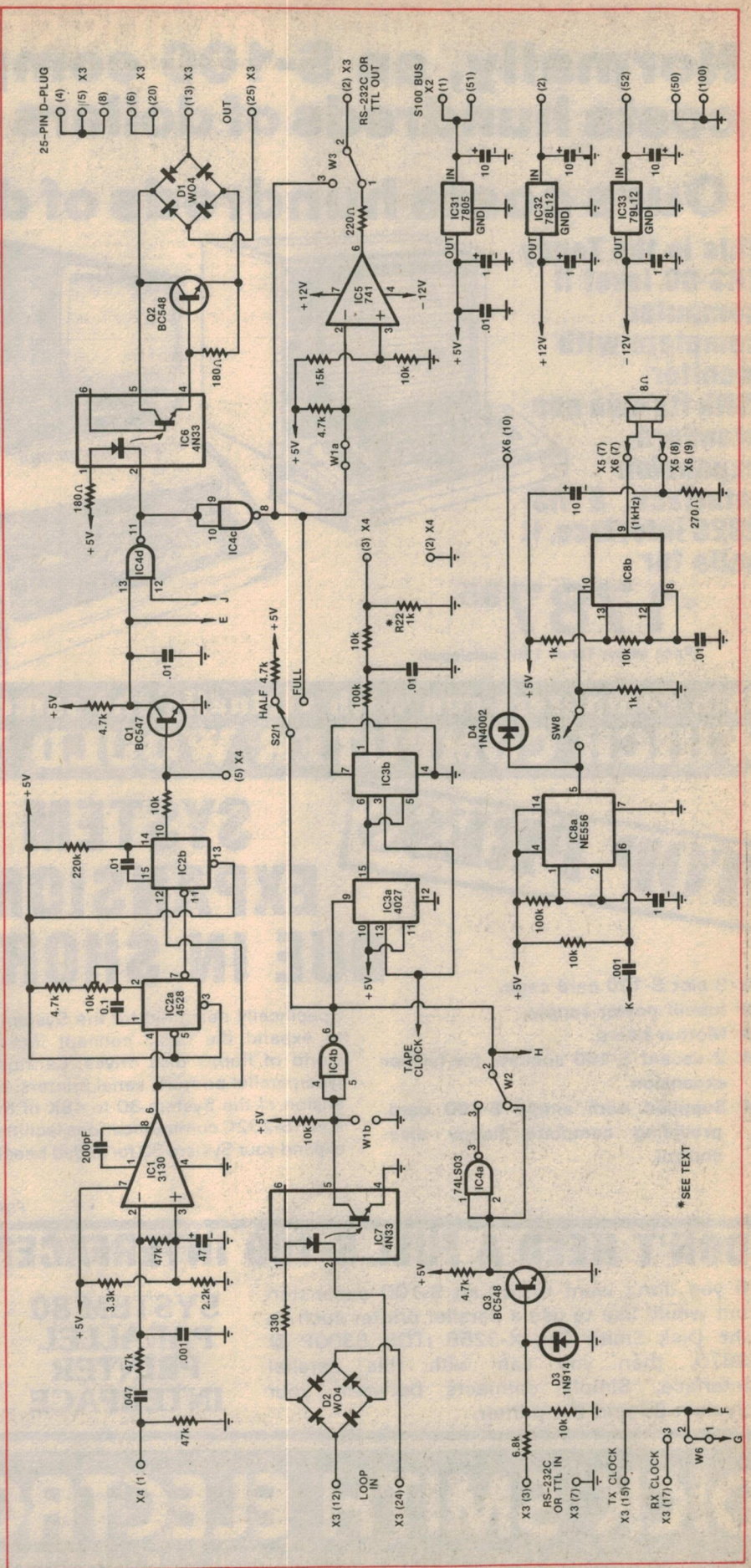
CASSETTE TAPE INTERFACE

Although simple, the cassette tape interface comprising only three integrated circuits, is easy to align and very reliable. In the "old days" of the ASR-33 Teletype all programs were saved by punching a paper tape at approximately 10 characters per second (110 Baud). The tape interface provided on this terminal is designed to store information at 300 Baud on an ordinary "audio" tape recorder. The recording format follows the "Kansas City Standard" which specifies the use of two audio tones for program storage on tape. When recording a "logic 1" eight cycles of 2400Hz tone is recorded, and, for "logic 0", four cycles of 1200Hz tone. During program recovery (play-back) these tones are converted back to TTL levels.

The tape interface recording circuit is wired to the serial input of the UART so that any data being received by the terminal is presented also to the tape interface, and is available for recording on tape. The playback circuit is logically Or'ed with the UART's serial output by gate IC4d prior to transmission to the computer.

The recording circuit requires a "clock" signal from which to generate the two recording tones. On this terminal the clock source is the first half of IC21, the crystal controlled dual Baud-rate generator. This clock is therefore extremely stable, and is synchronised to the UART's Baud-rate clock. The 4800Hz clock is applied to the clock inputs of the J-K flipflops IC3a and IC3b and the data to the Set input of IC3b. When the data is a logic 1, IC3b will be held set, and IC3a will divide the clock and output a 2400Hz tone. When the data is a logic "0" both IC3a and IC3b will divide the clock, and a 1200Hz tone will be output. The output is filtered (to smooth the wave shape) and the signal amplitude is reduced to match the "line" sensitivity of the tape recorder. The output level is approximately 500mV with R22 removed, and 50mV when R22 is installed. The value of R22 may have to be altered to satisfy the requirements of some recorders.

The playback circuit consists of an amplifier and a pair of monostable multivibrators (one-shots) which act as a frequency discriminator (or demodulator). The amplifier is a FET op-



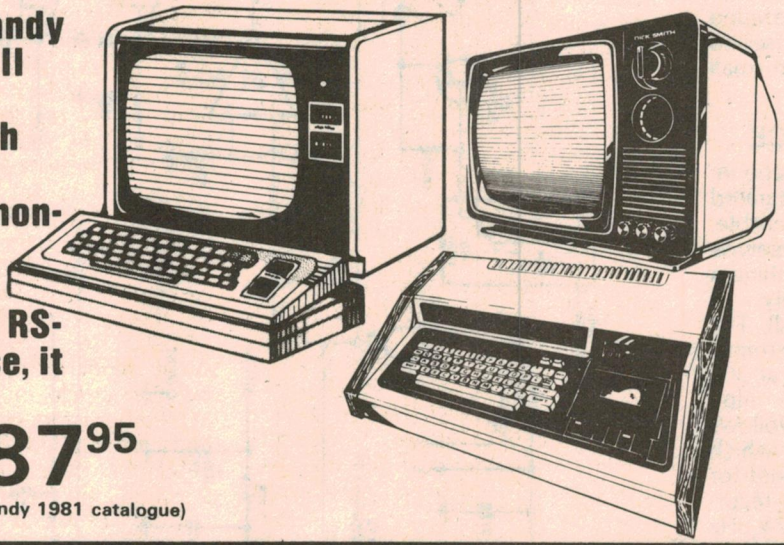
Normally, an S-100 computer costs hundreds of dollars more.

Ours costs hundreds of dollars less!

This is the Tandy TRS-80 level II computer complete with monitor. With its own non-standard expansion interface, & RS-232C interface, it sells for

$1787.95

(Price as per Tandy 1981 catalogue)



This is the Dick Smith System 80 level II computer, complete with monitor. With an industry standard S-100 bus expansion interface*, it sells for

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*Due in stock shortly.

Both computers run with virtually the same software. . .

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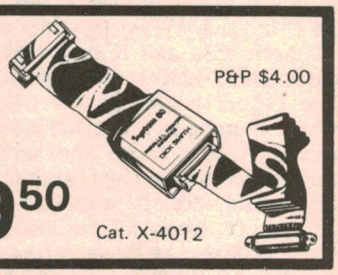

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amp operating open loop (very high gain). When an input of 40mV (peak to peak), or greater is applied to the input, the op-amp will saturate and present a 5V (peak to peak) square wave to both one-shots (IC2a and IC2b). When the input is a 2400Hz tone IC2a will be continuously re-triggered and enable the re-triggering of IC2b, and the output will be a logic 1. When a 1200Hz tone is received, IC2a will time-out before each leading clock-edge. Thus IC2b will be inhibited from triggering, and the output will be a logic 0. The time-delay of IC2a is set to the mid-point frequency (1800Hz) of about 555*us*. IC2b is pre-set and removes the symmetry distortion introduced by the one-shot discriminator action.

CONSTRUCTION

The assumption with this project is that the printed circuit board will be installed in an S-100 card cage as part of a comprehensive system which will include printed circuit boards for processor, memory and so on. So as far as this article is concerned, the description of construction centres on the assembly of the PCB.

Applied Technology Pty Ltd will supply complete kits for the project. (See advertisement elsewhere in this issue). The PCB will be supplied with a screen-printed component overlay so assembly should be a straightforward matter.

To save costs, it is likely that the PCB supplied will have only two gold-plated contacts on the integral PCB edge-connector. This makes sense since there is no point wasting gold on contacts which are not being used.

By the same token, much of the fairly hard-to-obtain hardware used by the author on the PCB will not be supplied. In this category are the four sockets along the top edge of the PCB, the plastic encapsulated wire links and the unregulated supply input connector near the three-terminal regulator.

Applied Technology have also advised us that hardware just mentioned, such as the socket for the RS-232 interface, is available with the kit at extra cost.

We recommend the use of a temperature-controlled soldering iron with a small tip, for best results. We also recommend the use of IC sockets, particularly for the more expensive IC types.

Assembly of the PCB can begin with the wire links and smaller components such as resistors, diodes and capacitors. Make sure that the polarity of diodes and tantalum capacitors is correct before soldering these components.

Next, the IC sockets and DIP switches can be mounted and soldered into place. Again, if there is a polarity indicator on the sockets, make sure that it is pointing the correct way before soldering. In this way, you are less likely to incorrectly install an IC which could have expensive results.

Next, the transistors, three-terminal regulators and other remaining components may be installed. That done, apply power and check that the voltage from the 5V regulator is within normal tolerances, ie, within 4.8 to 5.2 volts.

All that remains now is to install the ICs, and connect the keyboard and monitor. Two keyboards are available from Applied Technology who can advise on their features and prices. Suitable cases will also be available for the keyboards.

Finally, we should draw attention to some minor errors which appeared in the first article on this project, in the September issue. Firstly, the bell control code mentioned on page 82 of the September issue is control G not L or 1. Secondly, the reference to IC4 at the bottom of the first column on the same page should be to IC21.

Finally, we must apologise for not including the author's tables on control codes, wire link sets and connectors, due to lack of space. This information will be available with kits of the project.

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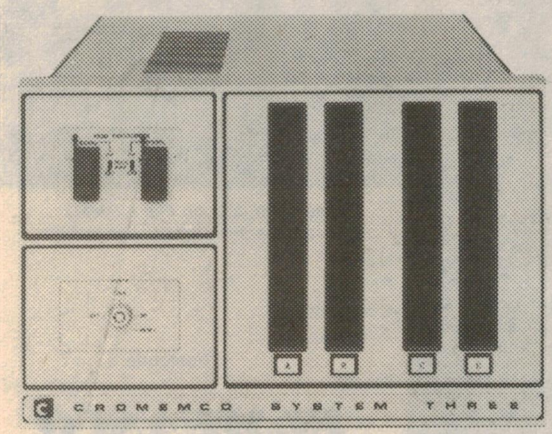

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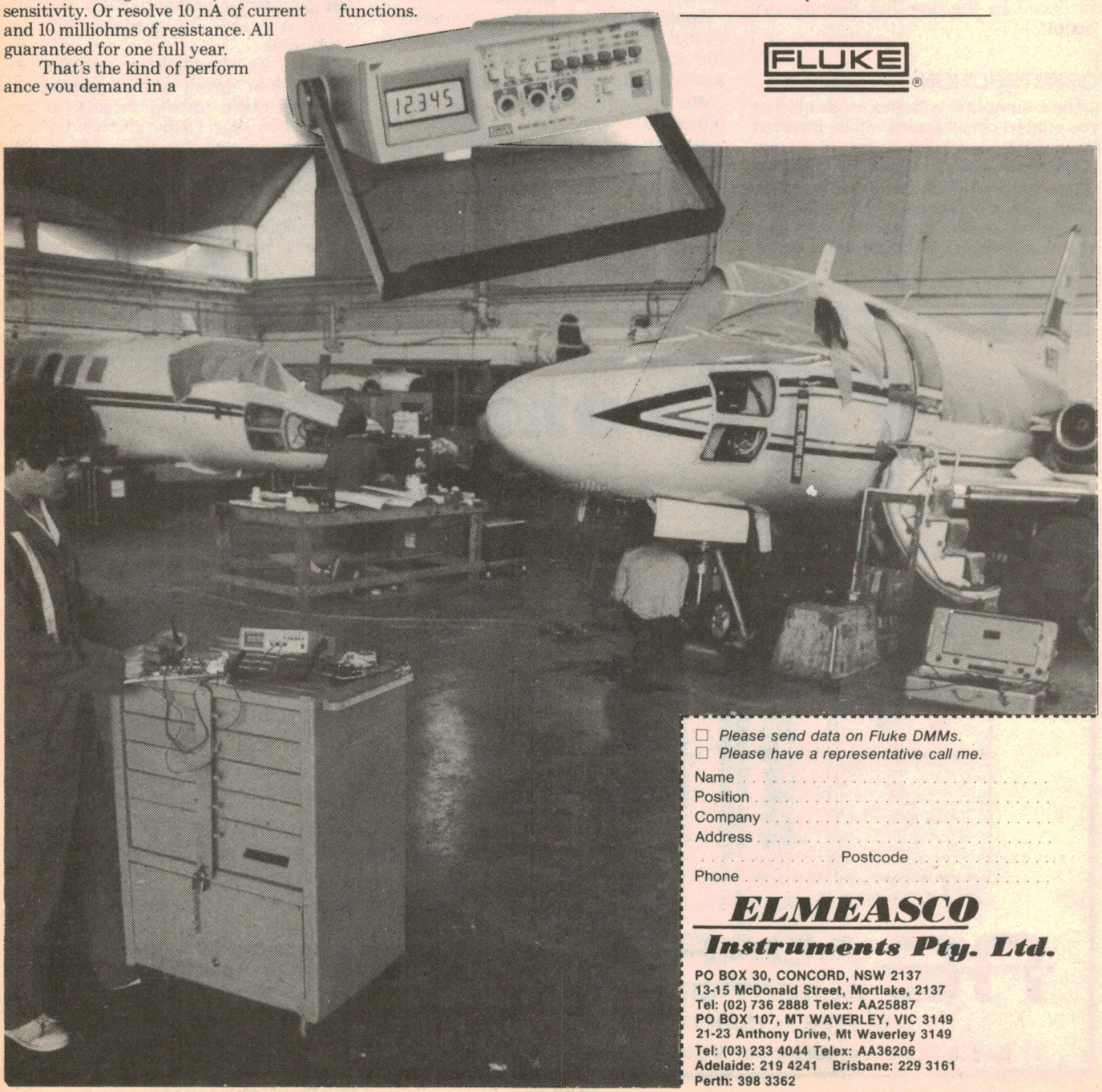

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Digital Stop Clock has LED readout

Most of us wishing to time an event would use a stop-watch, but for a partially sighted person this can be difficult or impossible. Here is one straightforward solution to the problem which readers may find interesting.

by DENYS CHAMPION*

The need arose for an event timer (period timer, or stop-clock, call it what you will) for visually handicapped telephone switchboard operators to time STD calls. The Royal Blind Society of New South Wales trains these operators, helps them to find employment and supplies them at subsidised prices with technical aids to help them in daily living and in the work situation.

Many visually handicapped people are also colour blind, generally to red, so the Society was looking for an event timer with a large green display, a timing period of 30 minutes or better in minutes and seconds, with facilities to "hold" the display at the end of the time period and for resetting to zero.

A search of the market did not find any suitable timer; in fact, event timers of any sort other than stop watches are difficult to find, so it was decided to design a digital event timer to meet the need. Again, none of the readily available clock modules met all the requirements in this case and only one integrated circuit clock chip was found which has a reset pin allowing all the on-chip counters to be reset to zero, as required in a stop-clock.

So it was decided to build a stop-clock using TTL ICs and separate green LED displays, as depicted in the complete circuit diagram.

The power supply is similar to that used in the Mini Frequency Meter published in "Electronics Australia" for May 1978 (File 7/F/22) and gives a regulated supply at 5V and an unregulated supply for the clock timing circuit. The output of the two diodes in the clock timing circuit consists of a series of pulses at twice the mains frequency, or 100Hz. These pulses are taken to a voltage divider consisting of a 390 ohm and an 820 ohm resistor in series. The junction gives a voltage suitable to drive a Schmitt trigger.

To filter any spikes coming in from the supply mains and to protect the Schmitt trigger, a .01uF capacitor and a zener diode are shunted across the 820 ohm resistor and a small signal diode is added between the input to the Schmitt trigger and the supply rail. The 100Hz square wave output from the Schmitt trigger is divided by each 7490 decade counter so that the output of the first 7490 is 10Hz and that of the second, 1Hz.

The 7492 is a divide-by-12 counter necessary to give a count of one minute every time the seconds count reaches 60 and resets to zero, and this is followed by a further 7490 to give a count of tens of minutes. Note that the connections to the 7492 are different from those on the 7490s. Each counter (except the first two) drives a 7475 which is a 4-bit latch, required to provide the hold facility. In the hold-mode, the display is held for as long as required, but the clock continues to run and if the hold switch is returned to the run position the display will "jump" forward to show the total elapsed time since the clock started from zero.

However, if the reset switch is operated while the display is on "hold" the clock will reset to zero, but the display will still be held until the hold switch is returned to "run".

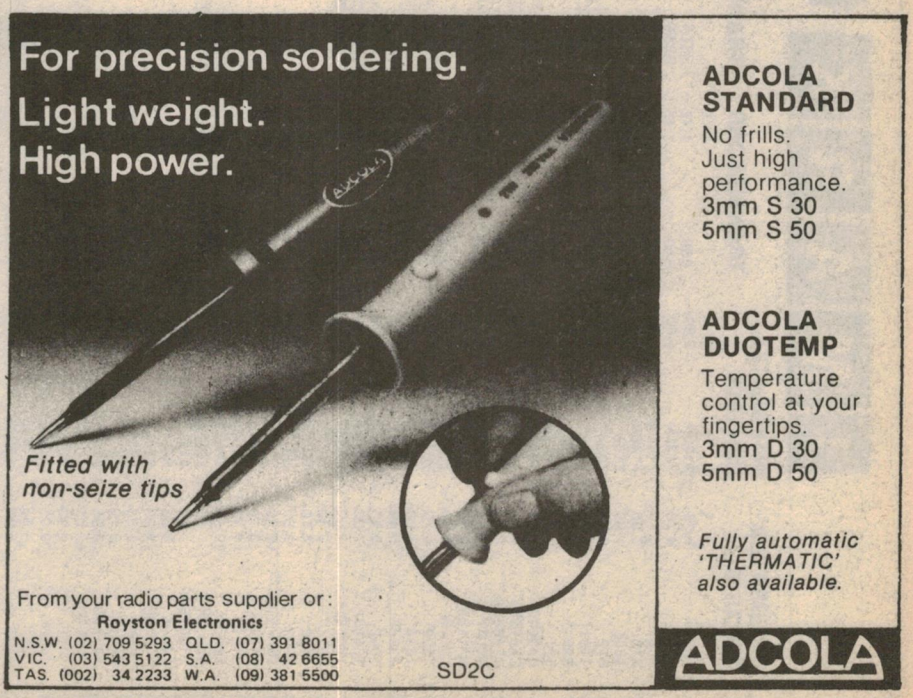
Each 7475 drives a 7447 BCD to 7-segment decoder/driver which converts the binary coded decimal input to an out-

We estimate that the current cost of parts for this project is approximately

$50

This includes sales tax.

** Denys Champion ASTC, FIE (Aust), VRD is a retired engineer who devotes much of his time to the Royal Blind Society of New South Wales, where he is Chairman of the Consultative Committee on Technical Aids for the blind and visually handicapped. On this project he was assisted by Phil Mallon, B Sc, BE, M Eng Sc, of the Department of Public Works, New South Wales.*



IMARK for Japanese ICs and Transistors

INTEGRATED CIRCUITS

	$ c
AN214	5.25
217	4.10
272	8.10
315	7.95
360E	1.95
612	5.10
7151	6.95
BA511	4.60
521	6.95
CA3012	8.20
CX075B	4.45
DS8654N	8.40
FX107	33.60
HA1199	4.55
1306W	5.40
1322	6.20
1338	11.20
1339A	5.45
1342	5.45
1366W	7.00
1366WR	7.00
LA1201	2.90
4420	4.10
4430	3.80
M5115PR	12.90
51202L	3.10
51513L	14.40
58476	29.95
MC14001	1.85
14001BCP	1.60
14011	0.65
14016B	2.90
14049	1.35
14511	3.10
14526B	6.95
14568B	12.55
1458	2.90
1496G	2.95
3340	5.65
4044	5.95
4069	1.35
MM5369AA/N	5.95
5799NBR	39.95
74C93	6.15
MSM5107	11.75
NDC40013	15.95
40044	24.80
NIS7261A	9.30
NJM4558D	2.85
PLL02A	11.95
RC4558	2.30
SL1626C	11.50
1640	8.80
74161	1.95
76115	3.65
76600P	5.55
TA 78	6.55
7045M	5.75
7060P	2.20
7061AP	2.75
7062P	4.70
7063P	2.10
7069P	4.45
7089P	6.35
7089M	7.30
7102P	11.55

INTEGRATED CIRCUITS

	$ c
7120P	1.80
7130P	4.60
7141AP	12.00
7146P	12.00
7153	25.60
7204P	4.85
7205P	4.55
7215P	12.00
7222AP	6.25
7310/ C3001AN	3.15
7310/ C3001AT	3.15
7310P	2.95
7313P	3.65
TBA810SH	6.80
TC4508	11.75
5032P	16.25
5080P	11.80
5081P	5.85
5082P	18.60
9100	13.95
TMS1943NL	16.00
UA 703	3.65
UPC78L05	1.75
78L06	1.75
78LO62AWC	2.70
78L62WV	2.70
78LO8AC	1.75
41C	5.40
555H	1.60
566H	1.25
575C2	4.95
577H	1.60
592H2	1.55
1001H2	5.20
1020H	5.45
1025H	6.60
1156H	4.85
1350H	6.00
UPD857C	6.30
858C	10.75
UP477–C12	69.00
CURTIS 8044	24.95

TRANSISTORS

	$ c
2SA101	1.15
240	1.90
473	1.45
489	4.30
493	1.30
495	0.65
495G	0.95
496Y	1.60
505	1.50
509	1.40
539	1.20
545	1.90
561	0.75
562	0.75
564A	1.40
628A	0.65
634	1.95
636	3.25

TRANSISTORS

	$ c
639	1.15
640	1.15
641	1.15
642	1.30
661	1.35
670	2.45
671	2.55
673	0.70
678	1.75
6820	2.40
683	1.15
684	1.35
706	4.20
715	1.90
719Q	0.90
720	1.15
733P, Q	0.70
740	7.60
748	3.00
758	8.65
794	2.45
816	1.90
844C	0.75
844D	0.75
950	3.00
969	6.30
999	0.65
1015Y	0.85
2SB56	0.80
77	0.95
156	1.90
187	1.00
324	0.95
337	4.50
405	1.35
407	4.20
415	1.10
434	3.65
440	2.10
2SB449	4.80
463	3.60
471	4.80
474	3.15
492	2.40
504	16.60
506	21.60
509	6.30
511	1.95
514	2.55
525C	1.45
529	1.70
536A	3.25
536B	3.85
541	9.60
544	1.10
555	7.30
596	3.65
617	6.00
764	1.20
2SC372Y	0.70
373	0.60
380	0.65
381Y	0.90
382	1.70
383	1.50
385A	1.45

TRANSISTORS

	$ c
387A	1.45
388A	1.15
398Y	2.30
399	2.15
403C	1.30
454L	0.50
458B, C	0.50
460	0.55
461	0.95
494	9.30
495Y	1.60
496	1.90
498	3.60
509Y	1.30
535A	0.70
536D	0.50
538A	1.50
562	1.95
563	1.95
605	2.35
620C, D	0.65
641	1.30
643A	8.65
644	0.70
685	3.00
693	0.55
710	0.70
710D	0.70
711A, E, F	0.55
712C	0.70
2SC717	2.00
730	9.90
732	0.65
733	0.65
734	0.90
735Y, O	0.80
738	0.75
756	7.30
761	1.90
762	1.90
763D	0.80
776	9.40
781	6.50
782	11.20
783	6.75
734R	0.90
785	0.85
789	2.10
792	6.75
793	6.30
799	6.25
815	0.90
828A	0.90
828O, P	0.90
829B, C	0.75
838H	0.85
839F, H	0.60
900E	0.70
900F	0.70
900U	0.70
901A	7.80
926	1.35
929	0.65
930	0.55
933	1.40
940L	6.40

TRANSISTORS

	$ c
941	1.20
945A, Q, R	0.70
945S	0.70
1000GR	0.85
1014C–2	1.65
1014D	1.65
1017	1.75
1018	3.80
1047	0.75
1060	1.70
1061A, B, C	1.60
1061D	1.60
1096	1.40
1098	1.95
1106	9.40
1124	2.20
1162	1.15
1166	1.00
1173	1.70
1175	0.85
2SC1210	0.70
1213	0.80
1214	1.90
1215	0.70
1222	0.70
1226A	1.25
1239	9.70
1260	6.40
1306	3.15
1307	7.85
1312	0.90
1313	0.75
1317	0.75
1318R	0.90
1327T	0.70
1328	1.20
1359	0.90
1360	1.05
1362	1.70
1364	0.90
1382	3.40
1383R	1.30
1384Q, R	1.05
1393	1.60
1394	1.30
1398	1.90
1419	2.45
1446	2.00
1448	3.70
1449	1.45
1450	5.50
1506K, L	1.55
1506M	1.55
1507K, L	1.55
1507M	1.55
1550	1.95
1571	0.65
1583	2.10
1589	5.30
1591	39.70
1647	0.70
1674	0.70
1675L	0.70

TRANSISTORS

	$ c
1678	2.35
1683	3.10
1685	0.75
1687	0.95
1688	1.15
1740	0.70
1760	3.20
1775E	1.15
1815GR	0.55
2SC1815Y	0.65
1816	3.60
1846R	1.40
1848	1.95
1856	1.20
1906	1.75
1908	0.95
1923R	0.85
1945	14.00
1957	1.35
1964	3.55
1967	26.60
1968A	39.65
1969BH	6.25
1973	1.85
1974	2.75
2028	2.75
2029	5.20
2053	1.50
2055	3.15
2073	2.85
2074	2.00
2075	2.95
2076	0.70
2086	1.05
2099	26.90
2116	4.45
2131	9.20
2132	68.25
2146	4.55
2166	3.65
2320	0.65
2327	9.80
2SD 30	1.30
111Y	10.50
113Y	26.10
180	5.95
187R	1.35
200	6.30
213	20.50
234	1.90
235Y	1.80
261	0.95
288	2.00
300	13.90
313E	1.80
315	3.40
325	1.60
330	1.75
350A	6.40
355C	1.05
359	1.80
2SD380	9.70
388	6.30
389	3.60
400	0.75
424	18.90

TRANSISTORS

	$ c
467	1.85
525	2.90
526	3.90
587SB	3.65
863	1.15
2SK19GR	1.45
19Y	1.40
30GR	1.60
30Y	1.30
33F	1.40
34E	1.25
40C	1.35
41D	1.05
41F	1.80
44	1.95
49H	1.85
54B	1.05
55D	1.05
55E	1.00
68L	1.00
107	1.60
3SK39Q, R	4.10

TRANSISTORS

	$ c
41L	2.85
45B	2.35
48	4.95
54B	3.05
59GR	2.90

CRYSTALS

	$ c
3.579545MHz	7.50
7.4015MHz	6.80
7.8015MHz	9.90
9.555MHz	4.80
9.565MHz	4.80
10.000MHz	6.35
10.020MHz	4.50
10.0525MHz	6.35
10.240MHz	6.35
10.692MHz	6.35
10.695MHz	6.35
12.800MHz	11.50
16.965MHz	6.20
17.065MHz	6.20
17.115MHz	5.20

CRYSTALS

	$ c
17.165MHz	6.20
17.215MHz	6.20
21.145MHz	11.50
32.520MHz	11.50
33.020MHz	11.50
33.520MHz	11.50
35.395MHz	11.50
35.500MHz	11.50
35.895MHz	11.50
36.380MHz	11.50
36.395MHz	11.50
37.36875MHz	11.50
39.16875MHz	11.50
40.9875MHz	11.50
41.000MHz	11.50
41.4875MHz	11.50
41.500MHz	11.50
41.9875MHz	11.50
42.000MHz	11.50
42.500MHz	11.50
43.500MHz	11.50
44.000MHz	11.50

IMARK PROPRIETARY LIMITED *167 Roden St, West Melbourne, Vic 3003 Phone: (03) 329 5433*

Also available in SA from Jensen Intersound & Electronics, 75 Prospect Rd, Prospect, SA 5082. Tel: (08) 269 4744; and in WA from Tri-Sales Pty Ltd, 452 Newcastle Street, Perth, WA 6000. Tel: (09) 328 4183.

Prices include S/T.

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Please send:

Quantity	Part Number	each $ c	Total $ c
		ORDER TOTAL $	
		Plus $1.00 post/pack	
		bankcard PAYMENT ATTACHED $	

Name .....

Address .....

..... P/Code .....

put suitable for driving the seven segment LED displays.

The writer used 12.7mm green displays available from Radio Despatch Service, 869 George St, Sydney and so far these have proved to be very satisfactory for visually handicapped persons. Of course any other size or colour display can be used where green is not required, as long as they are the common-anode type.

There is no decimal point connection on SEL 620 displays (why I don't know because the decimal point can be plainly seen in the moulding), so that if you require a decimal point a separate LED indicator must be placed between the seconds and minutes displays.

PARTS LIST

1 transformer, A&R 2155 or similar
4 SEL620 green LED displays
1 clock case
1 DPDT switch
1 SPDT switch
1 Heatsink for 7805 voltage regulator
Vero board, screws and nuts, hook-up wire, etc.

SEMICONDUCTORS
5 1N4002 rectifier diodes
1 4.7V zener diode
1 IN 4148 diode
1 7805 voltage regulator
1 74C14 Schmitt trigger
5 7490 decade counters
1 7492 divide-by-12 counter
4 7475 4 bit latches
4 7447 BCD-to-7-segment decoder/drivers

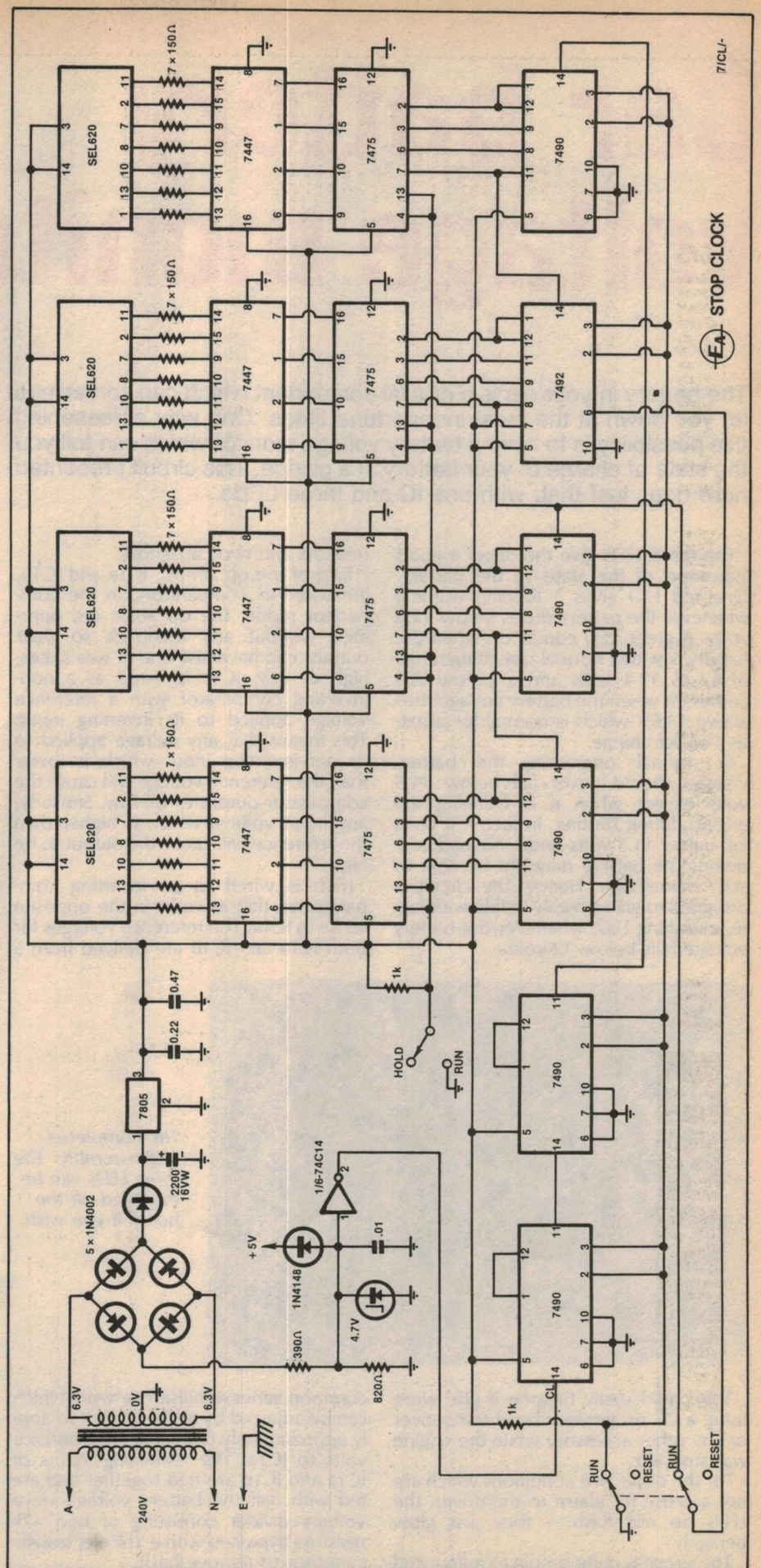
CAPACITORS
1 2200uF/16VW electrolytic
1 0.47uF metallised polyester (greencap)
1 0.22uF greencap
1 0.01uF greencap

RESISTORS (¼ or ½W)
2 × 1k; 1 × 820 ohms, 1 × 390 ohms,
28 × 150 ohms

As the clock depends entirely on supply mains frequency which constantly drifts about the mean of 50Hz, the clock accuracy is of the order of 0.5%, which is of course more than adequate for the purpose for which it was designed.

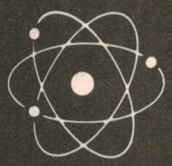
If fractional second display is required, the first two 7490 ICs can be connected to their own displays in a similar manner to the remainder of the clock, but if such accuracy is required it would be better to design a precision time base.

Although designed for telephone switchboard operators the prototype digital event timer is in fact now being used very successfully by a visually handicapped technician for program timing in an audio-visual recording studio.



Car battery voltage monitor

Basic Electronics



by GERALD COHN

The battery in your car is a crucial component which can sometimes let you down at the most inopportune times. One way of lessening this possibility is to have a battery voltage monitor which can tell you the state of charge of your battery at a glance. This circuit presented here does just that, with one IC and three LEDs.

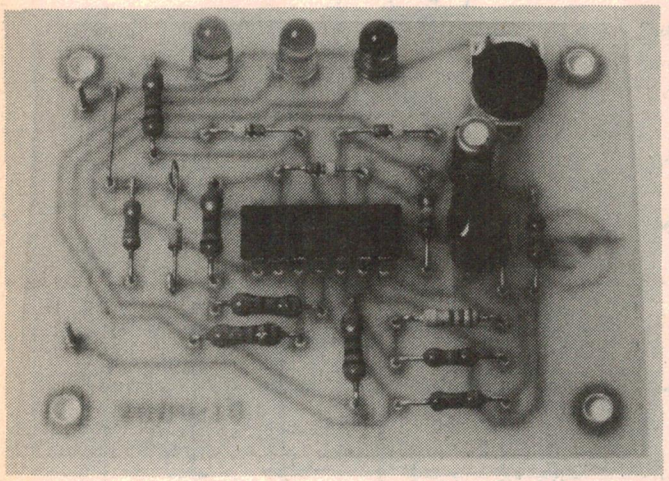
We estimate that the cost of parts for this project is approximately

$6.50

This includes sales tax.

The three LEDs give the driver a good indication of the state of the battery. One red LED gives a flashing warning whenever the battery drops below 12.0 volts. A green LED comes on when the battery is within normal operating range of 12 to 13.4 volts and a yellow LED comes on when the battery voltage rises above 13.6V which is normal for a battery under charge.

In normal operation, the battery voltage should never fall below 11.5 volts except when it is cranking the engine during starting. In fact, if it does fall below 11.5 volts under no-load conditions the battery may not be able to start the engine. Hence, the circuit is designed to give a highly visible warning, ie, a flashing LED, whenever the battery voltage falls below 12 volts.



The completed PCB assembly. The three LEDs can be mounted off the board if you wish.

This could easily happen if you were using a CB or amateur band transceiver or any other accessory while the engine was stopped.

For the other two conditions which are not a cause for alarm to the driver, the LEDs do not flash – they just glow benignly.

The circuit is quite simple to follow and uses just one 4136 quad op. amp. integrated circuit plus a few diodes, resistors and two capacitors.

Two of the op. amps., IC1a and IC1b, are wired as comparators. In the comparator mode, the op amps are operated without any feedback so their outputs can have just one of two states, high or low. IC1a is wired as a non-inverting comparator with a reference voltage applied to its inverting input. This means that any voltage applied to its non-inverting input which is lower than the reference voltage will cause the comparator output to be low. Similarly, any input voltage which is higher than the reference will cause the output to be high.

IC1b is wired as an inverting comparator so that it works in the opposite sense to IC1a. The reference voltages for both IC1a and IC1b are derived from a common zener stabilised network which can be adjusted by a 10k trimpot to apply approximately 6 volts to IC1b and 6.6 volts to IC1a. The remaining inputs of IC1a and IC1b are tied together and are fed with half the battery voltage via a voltage divider consisting of two 47k resistors bypassed with a 1uF electrolytic capacitor to remove hash.

If the battery voltage goes above 12 volts, more than six volts is applied to the inverting input of IC1b and its output will be low (turning off IC1d).

If you regard the supply voltage divider as having a ratio of exactly 0.5 (which it would have if the two 47k resistors were exactly equal in value), then if the battery supply goes below 12 volts, less than six volts will be applied to the inverting input of IC1b and its output will go high. This, in turn, enables IC1d which functions as a low frequency multivibrator driving the red LED which flashes a warning.

IC1a tests whether the battery voltage is twice 6.6 volts (13.2 volts) or more. If it is more, the output of IC1a will go high and turn on the yellow LED. So in IC1a and IC1b, we have a pair of comparators which tell if the battery voltage is below 12 volts or above 13.2 volts. A third comparator, IC1c, and two diodes, display the third condition, ie, between 12 and 13.2 volts.

Comparator IC1c uses the half supply voltage divider as its reference while a pair of diodes drive its inverting input which also has a 47k pulldown resistor. The two diodes and resistor actually form an OR gate: If either of the outputs of IC1a of 1b are high, the output of IC1c will be low and so its green LED will be off. But if both IC1a and 1b outputs are low (representing the condition between 12 and 13.2 volts), the inverting input of IC1c will be pulled low and its output will go high, turning the green LED on.

A prototype version of our circuit, which was adjusted to flash the red LED at 11.99 volts or less, changed from the green to yellow condition at 13.35 volts. The exact voltage limits will be set by the forward voltage drop of the diode in the reference voltage network for IC1a and 1b and by the slight effects of the bias currents drawn by the op. amps.

Total current drain of the circuit ranges

from less than 20 milliamps for voltages under 12 volts to just over 50 milliamps at 15 volts. At 15 volts, 30 milliamps passes through the 8.2V zener diode but this high current is inevitable if a reasonable current is to pass through the zener when the voltage falls below 12 volts.

So much for the theory of operation; let us now go through the excercise of building the unit.

All the components for the unit are mounted on a printed circuit board which measures 79 x 61mm and is coded 80bm10. Construction is quite straightforward and should only take about half an hour.

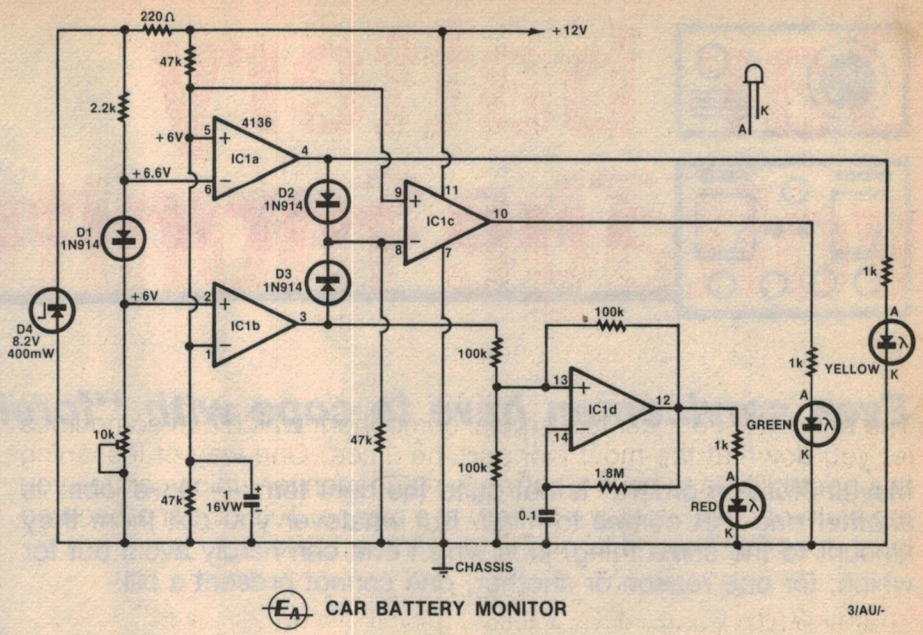
Start by placing all the resistors and the single wire link onto the board and soldering these into place. Follow these up with the trimpot and the capacitors, taking note of the polarity of the 1uF electrolytic. Next place all the diodes onto the board and carefully check that they are oriented properly. This includes the zener diode. Solder them all onto the board. The next three components to go onto the board are the three light emitting diodes (LEDs). Again, before soldering these into place check the orientation. The last component to go onto the board is the 4136 IC.

Before we continue on with the setting up of the unit, we suggest that you go back over the board assembly and check that all the components are in their proper positions and that all polarised components are placed as shown on the overlay diagram. Now check the underside of the board and make sure that there are no dry joints or solder bridges. If you are happy that there are no errors at this stage then continue on with the setting up of the unit.

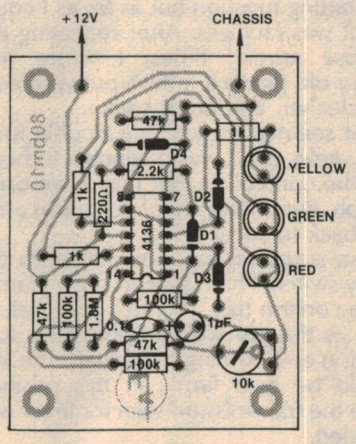
Calibration requires the use of a multimeter of known accuracy and, ideally, an adjustable low voltage power supply. If you do not have a power supply, a 12V car battery will do. Apply power to the unit, making sure that polarity is correct. Check the voltage across the zener diode to see that it is reasonably close to 8.2 volts (This will depend on the zener diode tolerance and the current through it but the voltage should be between 8.0 volts and 8.8 volts.)

Having checked the zener voltage and found that it is within normal limits, adjust the trimpot to obtain 6.0 volts at pin 2 of the 4136 IC. Then check that the voltage at pin six of the IC is close to 6.6 volts. It will normally be a little higher than 6.6 volts. That done, the PCB is ready for installation in the car.

If you have an adjustable power supply, the calibration will be a little closer to the ideal. Start by applying 12V to the circuit and checking the zener voltage as before. Now adjust the trimpot as already outlined. You can also check that each LED comes on within the correct supply voltage range and that the red LED actually flashes for low voltages.



IC1a, 1b and 1c function as comparators, while IC1d functions as a multivibrator.



This wiring diagram shows the PC board as viewed from the component side. Make sure that the IC, diodes, LEDs and electrolytic capacitor are correctly oriented.

PARTS LIST

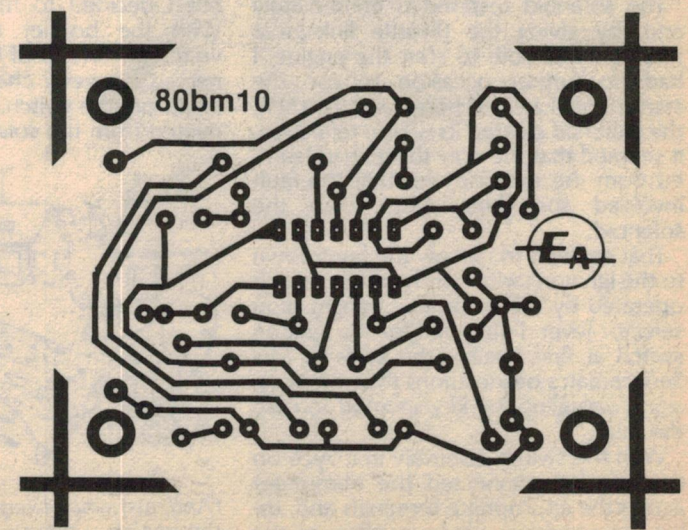
1 printed circuit board 79 x 61mm (80bm10)
2 PC pins, hookup wire, solder etc.

SEMICONDUCTORS
1 4136 quad op amp IC
3 1N914 diodes
1 8.2 volt 400mW zener diode
1 red LED
1 green LED
1 yellow LED

CAPACITORS
1 x 1uF/16VW electrolytic
1 x .01uF metallised polyester

RESISTORS
1 x 1.8M, 3 x 100k, 3 x 47k, 1 x 2.2k, 3 x 1k, 1 x 220 ohm
1 x 10k miniature horizontal mounting trimpot

Here is an actual size reproduction of the PC pattern (see back page for information on where to buy PC boards).



The Serviceman

Even servicemen have to cope with "foreign orders"

Maybe "foreign orders" is not quite the right term — "love jobs" is another one that comes to mind. But whatever you call them they amount to the same thing; jobs which one can hardly avoid but for which, for one reason or another, one cannot present a bill.

The first case is probably as close to a "love job" as I'm ever likely to get; it involved Mrs Serviceman's car!

In fact, it involved the starter solenoid circuit, and a nasty habit of it periodically going dead. In most cases it would come good after a minute or so but it seemed completely unpredictable. And, as might be expected, it seldom happened when I was driving the car.

It did happen when I was driving on one occasion, and in the most inappropriate circumstances. I was pulling out of a parking space and half-way through a "U" turn when the still cold motor cut out. When I turned the key nothing happened, leaving me stuck half-way across the road.

Naturally, I wasn't in much of a mood to worry about the basic theory of the failure; all I wanted to do was get the bomb moving as quickly as possible. Diving under the bonnet I located the energising lead to the solenoid and pulled it off the terminal. Then using a length of wire which I had handy, I bridged the terminal to the active battery terminal.

The solenoid responded immediately and, by giving the throttle linkage a nudge, I was able to start the engine. I had no further occasion to use the starter until I arrived home and, by then, the fault had cleared itself. On reflection, it seemed that the only thing I had learned from the exercise was that the fault involved something other than the solenoid.

That seemed to narrow the hunt down to the ignition switch or the safety switch operated by the automatic transmission selector lever. I plumped for the ignition switch at first, mainly the basis of Mrs Serviceman's observations that, on occasions, wriggling the key seemed to cure the fault.

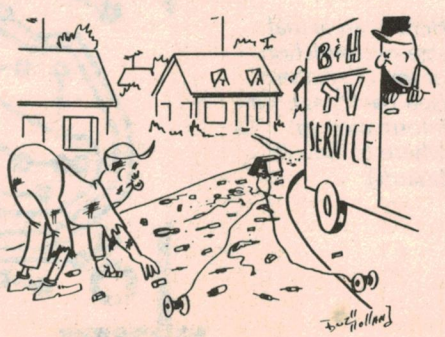
With the switch assembly in a vyce on the bench I connected the ohmmeter across the appropriate terminals and, using a screwdriver blade in place of the locking mechanism tongue, I simulated the starting function but as far as I could see, it was faultless. After repeating the exercise several times, I wrote that theory off. I gave it a flush out with contact cleaner, and put it back.

That seemed to cure the trouble for a few weeks, and I was beginning to hope that the contact cleaner may have done the job. But then it happened again and I was back to square one.

Since suspicion had now fallen on the safety switch, I had worked out a plan to try to confirm this. The idea was that, as soon as the key was turned to the start position and nothing happened, the key should be held firmly in this position while the transmission selector lever was wriggled.

Mrs Serviceman was the first victim after that and she reported that the system responded immediately the lever was moved. Soon afterward, I was confronted with the same situation; sure enough, the starter functioned as soon as I moved the lever.

All of which seemed pretty conclusive, but I decided to make one final test. With the bonnet open, I set up a voltmeter on top of the air cleaner, connected between chassis and the active lead from the switch, which I had disconnected from the solenoid terminal.



"And, just when I've got it on full throttle, the engine suddenly fires . . ."

With this arrangement I could watch the voltmeter from the driving seat. At first, moving the key to the start position brought up full battery voltage but then, as I wriggled the selector lever in the "park" position the meter flickered, and it wasn't hard to find a spot where it dropped to zero. The same behaviour was oserved in the "neutral" position, though to a lesser degree.

That removed my last doubts, and I promptly fitted a new safety switch. (The fitting was not without its own problems, but that's another story.) And that cured the problem – for about three weeks! Then Mrs Serviceman reported another failure. It seemed that the starter had failed at the first turn of the key, but had responded immediately at the second try.

Nor was it long before our fears were confirmed; it not only occured several more times, but was rapidly becoming more frequent.

I pulled the ignition switch out again and repeated the bench test. This time its behaviour was not one hundred per cent; once or twice I detected a momentary failure.

The conclusion was obvious; fit a new ignition switch. Granted, I still had some doubts, but it seemed like cheap insurance. And, again, the problem vanished – for just long enough to lull us into a false sense of security. Then it was on again.

By now I was getting desperate. With the ignition switch and safety switch both replaced, it seemed to leave only the solenoid, in spite of my original observations. Either that, or it was some more subtle fault in the wiring. The problem was how to track it down.

Then, about a week later, my luck changed. While attempting to start the car in the carport, the fault not only appeared, but gave every indication of remaining. Determined to make the most of the opportunity, I slipped the insulating cover off the solenoid terminal and connected the voltmeter lead to it.

From the driving seat I operated the key and observed that the meter read full battery voltage even though the solenoid did not operate. That left two possibilities; either the solenoid coil was open circuit or there was a mechanical

fault affecting the plunger.

A resistance measurement between the active terminal and chassis produced a reading of about one ohm, which seemed reasonable enough for a device of this kind. So it had to be a mechanical fault in the plunger mechanism.

My practical knowledge of solenoids was virtually nil, and I had some misgivings about pulling one apart. On the other hand, having come this far, I was anxious to finish the job. The solenoid was held by three screws at one end and it looked a simple enough job to undo these and take it off.

But I quickly realised that the whole thing appeared to be under spring tension, and I had visions of everything flying apart and scattering bits everywhere. Nevertheless, I carried on, and found that it wasn't as bad as I feared. The coil came away, leaving the plunger atached to the starter housing by a spring, with one other loose spring which was easily re-fitted.

On the bench I was able to study the solenoid in detail. There were two heavy duty terminals, one connecting to the battery, and the other to the starter, plus the activating terminal connecting to the ignition switch.

But there was something else, which puzzled me. Under the heavy duty terminal for the starter lead was a solder lug and to this was soldered a heavy wire (about 14g) which emerged from the case between the two terminals. It looked like one end of the coil, but I couldn't understand why it was terminated in this way. And, according to the ohmmeter, it was about one ohm above chassis.

On the other hand, its purpose didn't seem very important at this time. I was more anxious to find some mechanical reason why the plunger was not operating. In fact I could find nothing; no foreign matter, and every indication that it should function normally.

So what now? While waiting for inspiration I made a routine examination of the heavy duty terminals. In fact, I found nothing wrong, but I did find something else.

In making the check I had removed the tension from the solder lug terminating the coil and I suddenly realised that the soldered joint between it and the wire did not look the same as it did before. A magnifying glass confirmed my suspicion; there was a clear gap between the wire and the blob of solder.

In fact, on removing the nut, and straightening the wire, I was able to lift the lug clear. And, while at that stage I was still unsure as to the exact electrical configuration, I had not doubt that this was the cause of the trouble.

I tinned the lug on both sides and it took the solder extremely well. The wire itself was another matter. It was grubby and corroded and had only one tiny area of solder on it.

However, after a lot of scaping I was able to tin it properly, reassemble everything, and finish the job.

That was many months ago, and the system hasn't missed a beat since.

And what about the strange coil connection on the solenoid? Further inquiry solved this mystery. There are actually two coils in this solenoid; a "shunt" coil and a "series" coil. The shunt coil connects between the activating terminal and chassis; the series coil between the activating terminal and the lead to the starter motor.

Its purpose – apart from providing some of the magnetic field necessary to pull the plunger in – is to direct a limited current through the starter, causing it to run gently and thus more readily engage its pinion with the ring gear. When the plunger completes the main starter circuit this series coil is shorted out.

It was this series coil which was not being activated and, without it, the plunger could not respond. It also explains why I was confused by the continuity measurement I made on the coil.

FOREIGN ORDER No. 2 . . .

The other foreign order involved a problem encountered by my amateur friend, while overhauling some equipment on behalf of his WICEN group. (See also March 1980 notes.) The unit in this case was an old AWA MR10 Carphone.

It had already been converted to the appropriate amateur band, but had not been used for many years. And, as the owner recalled, it had never been a particularly good performer. So my friend "was volunteered" to overhaul it.

There turned out to be a lot of things wrong with the unit, but mostly routine faults such as dried out electrolytics, resistors gone high etc. There was also a faulty aerial change-over relay which probably accounted for some of the "poor performance".

With these faults cleaned up the set was starting to come good, but there were still a couple of nasty ones in the receiver. It was a two-channel system, with a relay to change from one crystal to the other; this function was unreliable. On occasions, switching from one channel to the other would result in the crystal oscillator dropping out.

The fault was mechanically sensitive, in that tapping the chassis near the relay, and particularly the relay itself, would produce loud crackles before restoring the oscillator function. Naturally, the relay was the first suspect.

But this suspicion could not be confirmed. My friend had checked every aspect of the relay without finding anything wrong. He had even established that normal operation could be restored by exerting pressure on one of the relay's fixed contacts, even though he could find no fault with them.

He had also observed another symptom which seemed to be related, but which could have come from another fault. This was a tendency for the receiver gain to drop after the oscillator

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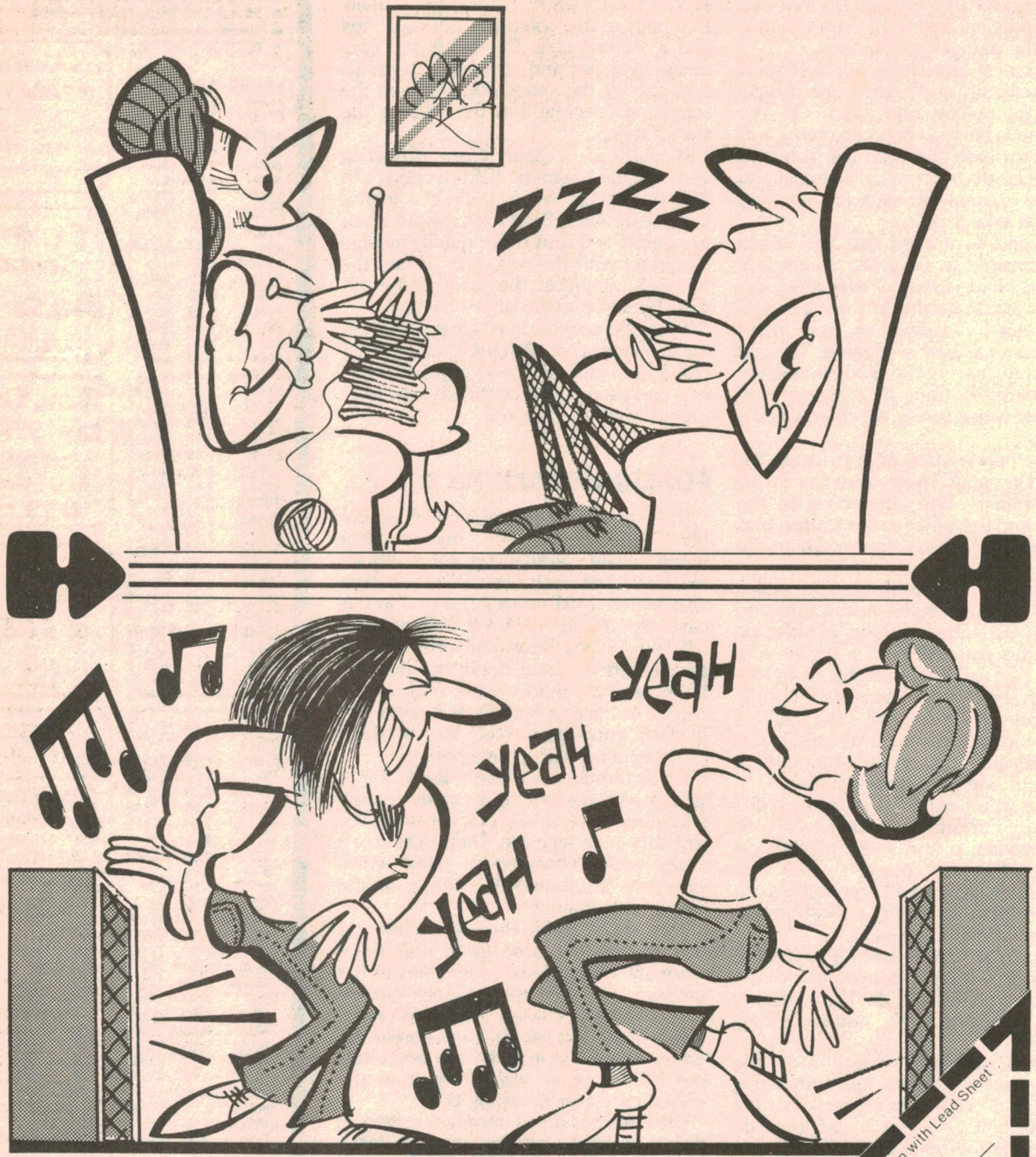

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had failed and been restored. This characteristic also appeared to be mechanically sensitive and, in addition, had once shown a cyclic pattern; the gain would come good for 10 or 15 seconds, drop for a similar period, then come good again, and so on.

It was at this point that he approached me. Remembering how valuable the signal generator had been in solving his previous problem he asked whether he could use it again. I readily agreed.

Thus it was that he brought the set into the workshop and set it up on some spare bench space. Finally, when he had it all working, he called me over. Apparently he had been lucky in that the fault had elected to turn on a good demonstration.

One of the features of these sets is a number of metering sockets to facilitate testing and adjustment, including one in the crystal oscillator/multiplier chain. My friend was using this to monitor the crystal oscillator behaviour.

It was exactly as he said: The set would behave normally on, say, channel "A", would drop out when switched to channel "B", and remain out when switched back to channel "A". But a couple of sharp taps on the chassis near the relay would restore it.

Alternatively, it could be restored by pressing on one of the fixed relay contacts, and this had me particularly intrigued. I noted that considerable pressure was needed – much more than seemed reasonable for a simple contact failure. In fact, it seemed to me that the contacts were not involved at all.

To prove the point I went through the switching sequence again to put the oscillator out of action, then bridged the suspect contacts with a clip lead. This had no effect, but pressing on the contacts restored oscillation as before – a patently silly situation!

With the relay contacts cleared of suspicion, we began to look further afield, but keeping in mind that, whatever the trouble was, it still responded to pressure on the relay. And that was the clue we needed.

By pressing gently on various components adjacent to the relay we finally found one that responded to the slightest pressure. It was a 10k decoupling resistor feeding the plate circuit of one half of a 6J6 twin triode; a multiplier stage following the crystal oscillator.

One end was pretty well obscured by other components but when we moved these aside the fault was obvious. The pigtail had to turn through about 90° to reach its terminal and, whoever had fitted the resistor had cut the pigtail a little too long. As a result, the curve of the pigtail was resting against another terminal – that belonging to the second set of contacts on the relay.

And so the mystery was solved. Pressure on the upper set of relay contacts, and the movement resulting from it, had been transferred to the lower set which was being fouled by the resistor pigtail. Apparently the clearance was so minute that activating the relay was enough to close it and pressing on the other contact was enough to open it.

But that left the other, rather nebulous, fault still to be accounted for. Had it been part of this fault, or was it something quite different? We didn't have long to wait to find out. My friend decided to take advantage of the generator to go right over the front-end alignment.

It was while he was doing this, and at a point where the set was exhibiting a sensitivity of well under 1uV, that it suddenly dropped its bundle and needed about 200uV. Then, after about 20 seconds, it came good again, only to fail yet again after a further brief period.

It continued in this manner until, eventually, the poorer condition became permanent. Good performance was restored only by switching the set off for 10 minutes or so, then switching it on again.

Fortunately, the fault had become consistent. By feeding the generator into the second IF my friend was able to establish that all was well from this point on, leaving the RF stage, first mixer, and second mixer as the prime suspects. And, from the symptoms, I was sure that it was a heat sensitive fault in one of these valves.

AN INSPIRED THOUGHT

But which stage was it? Suddenly, looking at the circuit, I had an idea. This set uses lots of decoupling networks; virtually one for each stage.

As a first try I suggested monitoring a decoupled point which supplied all three stages, and this proved we were on the right track. When the sensitivity dropped the voltage rose significantly.

The next most convenient point was the decoupled supply exclusive to the first mixer, a 6AU6. With the set working properly there was about 50V at this point but, when the sensitivity dropped, the voltage shot up to over 100.

That left no doubt that this was the faulty stage; probably a thermally sensitive open circuit cathode lead. This was confirmed by plugging in a new 6AU6, after which the fault vanished.

So that's my score of non-productive activities for the month – and for several months I hope! Still, I really shouldn't complain; I hate to think what it might have cost me had I passed Mrs Serviceman's car over to an auto electrician. No reflection on these gentlemen, but it was the kind of fault one really has to live with to track down positively.

As for my friend's amateur gear – well, I did get a story out of it!

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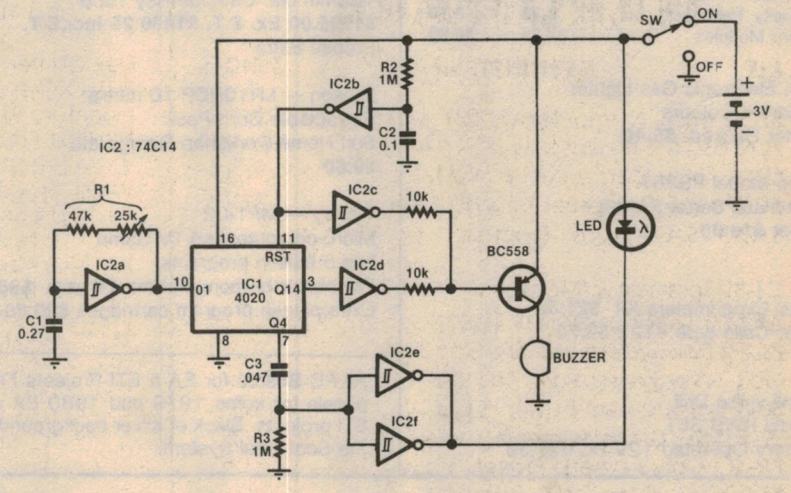
Conducted by Ian Pogson

This timer takes very low current

When the timer is switched on, the circuit shown will provide a time lapse of from 5 to 30 minutes before an audible alarm is sounded. It takes extremely low current, typically 20uA at 3V and 10mA when the buzzer operates. Under these conditions, two AA-size dry cells should supply this timer for a year or more, provided the buzzer does not operate for too long periods.

The circuit includes a "switch-on reset" facility to ensure the proper operation of the 14-stage binary counter IC1. This is achieved through R2, C2 and IC2b. During the reset period, the buzzer is sounded. This confirms the reset procedure and doubles as a low battery warning indicator. If the buzzer does not operate during switch-on, it is likely that the battery needs replacement.

IC2e and IC2f are paralleled to flash the LED whenever the timer is sounding. The differentiating network of R3 and C3 ensures a short blink each time, in order to preserve battery life.



By changing the frequency of oscillation of IC2a with R1, the time lapse can be varied. As the output is taken from the 14th output stage of the counter, the time lapse is equal to 2^{14} times the period of oscillation of IC2a. At 3V, the period is given as approximately 1.4R1C1.

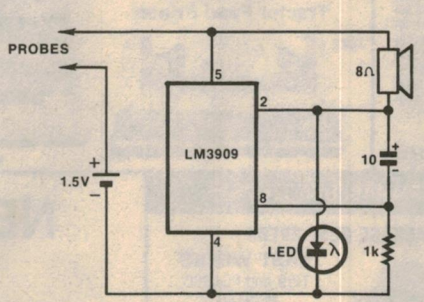
(By Mr T. G. Tang, PO Box 26, St Lucia, Qld 4067.)

An audio-visual continuity tester

I have built an audio visual continuity tester using one LM3909 IC and three other components, besides a battery and a speaker (based on a circuit in the National Semiconductor data book). This device is ideal for low resistance and impedance components, electrolytic capacitors, transistors and coils. It could also be employed to trip a relay for touch alarm equipment.

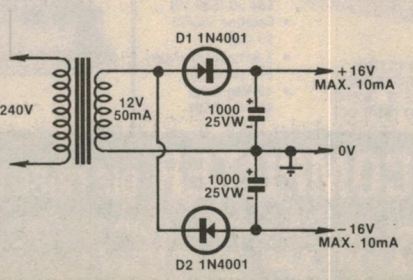
The prototype uses a 1.5V alkaline cell and it is built on a 20 x 25mm copper strip board and all contained in a small plastic case. I used a Ronson gas lighter presentation case. The speaker has an 8 ohm voice coil and was salvaged from a miniature transistor radio receiver. An adhesive, such as Bluetack or Araldite may be used to hold the various components in position where this is needed. The pitch of the sound may be increased by connecting a 2.2k resistor between pins 1 and 8 on the IC.

(By Mr C. Bately, 20 Birch Street, Christchurch 7, New Zealand.)



Simple symmetrical power supply

Normally, a centre tapped transformer and a bridge rectifier are used to construct a symmetrical power supply. This seems such a natural solution that it is often overlooked that it can be done in a much simpler way. The accompanying circuit diagram shows the simpler version. A disadvantage is that the half-wave rectification makes it necessary to use a larger smoothing capacitor to prevent mains hum.



With the values shown, a maximum of 10mA can be supplied at a ripple voltage of about 0.2V peak-to-peak. By using the formula below, values for other currents and ripple voltages can be calculated.

$$V_{ripple} = (20 \times 1)/C$$

where V_{ripple} is in volts peak-to-peak, derived current I in mA and C in uF.

(From "Elektor", July/August, 1980.)

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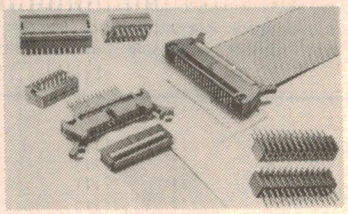

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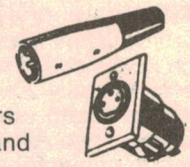

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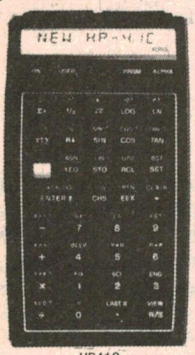

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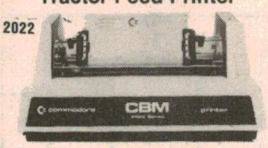

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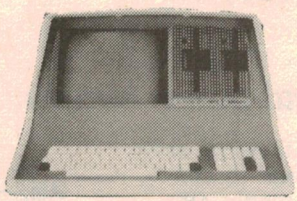

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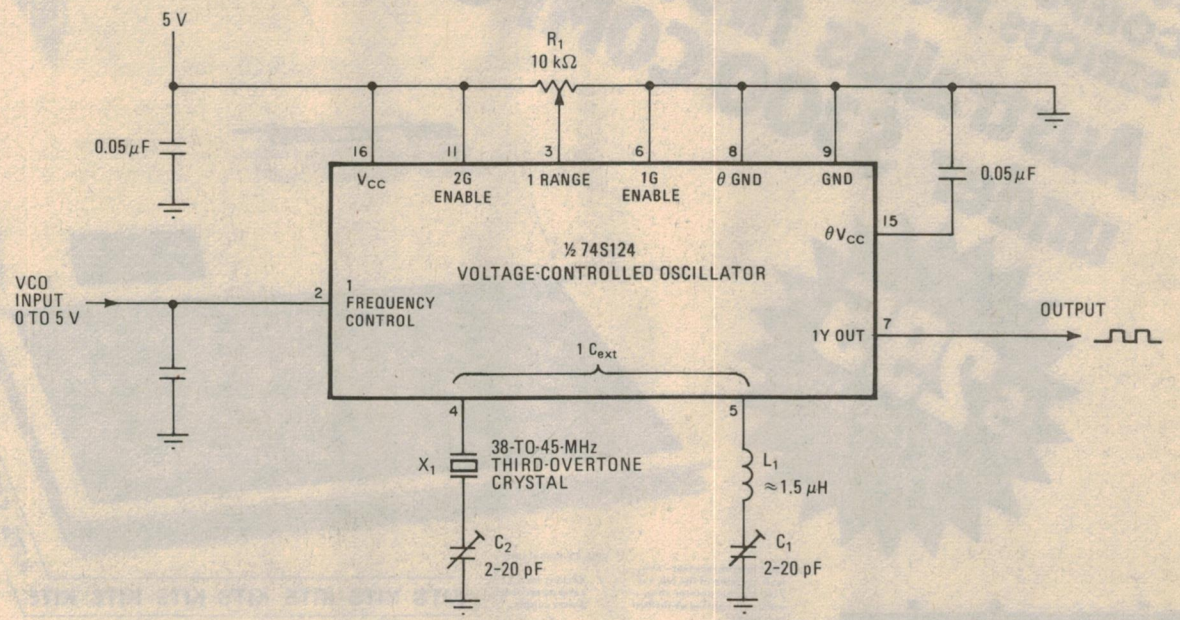
LC network adapts PLL for crystal-overtone operation



Although Texas Instruments' popular 74S124 oscillator serves reliably in most instances as a crystal controlled phase locked loop, problems arise when overtone crystals are utilized for high frequency (20MHz and above) operation. The difficulties may be overcome by adding an LC network in order to retain adequate system gain for oscillation at the required overtone and dampen oscillations at the fundamental frequency. This technique thereby forces the loop to lock onto the third order output of the crystal.

Although the range over which the PLL responds will be limited to about 1kHz for a 0-5V input signal, the method affords repeatable results and will enable use of the 74S124 beyond the normal limits imposed by fundamental mode crystals. As shown in the figure, L1 and C1 are selected to be series resonant at the desired overtone frequency. Assuming L1 is 1.5uH, a C1 value of 2 to 20pF will be adequate for tuning over the range of 38 to 45MHz required in this particular application. The Q of both L1 and C1 should be reasonably high.

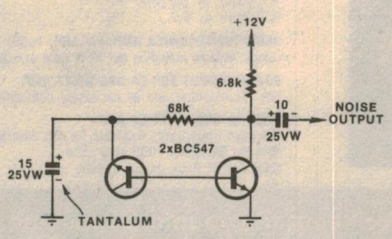
C1, along with R1, serves as a gross frequency control. Unfortunately, the setting of R1C1 will be rather critical. Although the range over which R1 is effective as a tuning element for a given C1 is narrow, a miniature carbon potentiometer will have sufficient resolution for making adjustments. C2 provides an offset for the desired third overtone frequency. In general, the circuit will work satisfactorily for crystals working to 60MHz.

(By R. J. Athey, in "Electronics," November 22, 1979.)

An economical white noise source

This simple circuit provides a white noise source which is suitable for direct connection to the high level input of an audio amplifier. Some possible applications include using the white noise to blanket out background sounds or for checking the frequency response of tape decks or speakers.

Two BC547 NPN transistors are used in the circuit with one of the transistors connected as a current amplifier and the other as a noise-current source. This is achieved by reverse biasing the base-emitter junction so that the transistor operates as a zener diode. Q-point



stability is provided by the 68k "collector biasing" resistor and a 15uF decoupling capacitor.

(By Ron de Jong, "Electronics Australia".)

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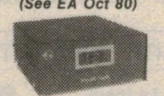

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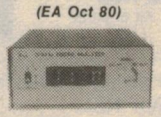

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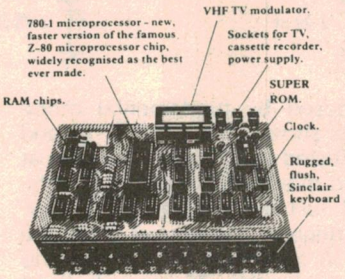

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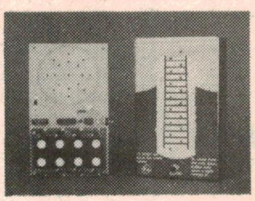

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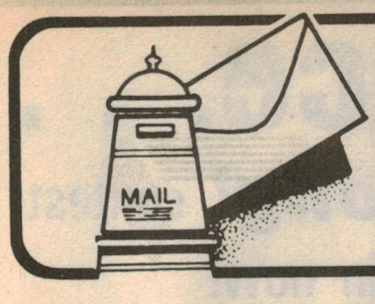

Letters to the editor

Power transmission and conversion

Your article in "Forum" of the February, 1980 issue awoke memories of a seminar which I attended many years ago, (about 20, I think).

If my memory serves me correctly, the Swedish firm, ASEA, had at that time, been working for many years on the problems of converting three phase alternating current to DC and subsequently reconverting to three phase current in synchronism with the mains frequency.

Their object was (and still is so far as I know), not related to storage of off-peak generated power, but rather to the transmission of electrical power across natural water hazards such as occur in Sweden, the English Channel and between the north and south islands of New Zealand. And by implication, between Tasmania with its vast hydroelectric capacity and the mainland of Australia.

One of the advantages, apart from reduction in cable costs, is the ability of the system to convert electric power to the exact frequency of the receiving system, regardless of any phase differences which may be present between the supplier and the receiver.

The subject of DC to AC conversion is becoming more important, as you have already commented in "Forum". A recent bulletin which I received from the Lead Development Association has an interesting short article, relating to storage of off-peak generating capacity in accumulators and reproduces a photograph of one of the very large accumulators being manufactured for an American power supply company. The theory apparently is that it is cheaper to build and maintain such large batteries and associated equipment than to use gas-turbine driven alternators to fill in the gaps during periods of peak demand.

The practice of using gas-turbine alternator sets to supply extra capacity at peak periods is quite common in the USA.

Thanks for producing an interesting magazine. As a continuing reader, starting from the old "Wireless Weekly", (with its "Technical Notes" and all), right through to the present broadly based format, I think that I can fairly state that I am in a position to assess its relative merits and reader interest. I, certainly, have always enjoyed your magazine sometimes more than others of course and I do have a sneaking suspicion that your original publication may have given me a slight nudge towards the direction of my profession.

C. M. Livingstone,
Union Carbide Aust Ltd,
Rhodes, NSW.

Vintage receiver: help given

I wish to thank you for publishing my letter seeking constructional details on an early model crystal receiver.

To date, three readers have responded and provided more than adequate data as well as interesting historical information on this class of receiver and the existing broadcasting service during the 1920s. The whole exercise has been a most satisfying one and has resulted in the authentic reconstruction of an interesting link with our past.

Peter J. Martin,
Seaford South, Vic.

COMMENT: We are pleased to learn that publication of your letter has brought results. Our thanks to the three readers who offered their help.

Duck ponds and computer books

Fie on thee Sir,
or on thy unprincipled vassals
for didst not the people of Australia read
in this missive of things electric
that there was a goode booke called
"Basic Computer Games"?
And – didst thou not say that this was
indeed a goode booke?
Prithee take one program named "Golf",
type the words and numbers into a
machine, and thence learn the value of
false advertising.

It has lines unconnected;
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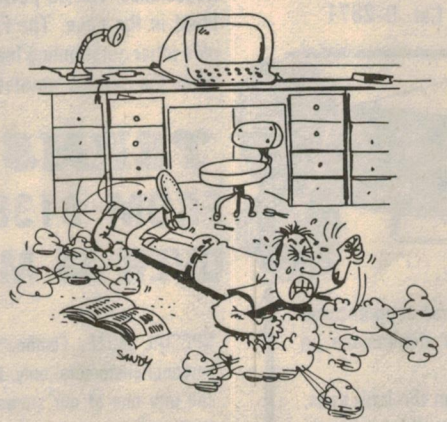
a loop of unending nothingness;
and is known to those who serve the
mighty Lord Program.

It is considered to be a most excellent excercise in the most foul art of "debugging" and is so used by those teaching others.

It is not a program – it is in truth a conundrum fit to while away the hours, nay even the days – in pleasant frustration.

May the sherriff of thy court have



cleaned the duck pond before placing you in the stool.

Colin A. Clunie,
Surrey Hills, Vic.

**COMMENT: O Ye of little faith;
Thou shouldst be thankful for what thou receive.
Begone, knave into the eternal darkness where there is everlasting weeping and endless error messages.**

New outlet for digital recordings

I am sure that your readers will be interested to learn that direct-to-disc and digital recordings are now stocked along with a large range of classical recordings at Miranda Fair Records, Miranda Fair.

We obtain our stock from Acoustic Monitor, Janda and EMI, and carry some 12 different labels, including Telarc, Toshiba, Decca and Sheffield Lab.

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M. Kentley,
Miranda Fair, NSW.

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The winner will be notified by Dick Smith, and will be announced in Electronics Australia and Electronics Today International.

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All entries must show the model number and serial number of the item purchased, (if applicable), and be signed by the store manager or authorised person.

In the space on the entry form, write in one paragraph of not more than 50 words.

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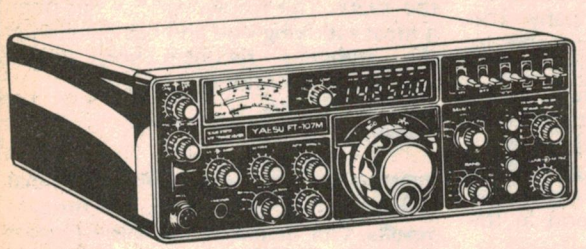
Entries close at 5pm on Monday, 3rd November, 1980. Entries received after this date will not be considered. Final judging will take place on 10th November, 1980. The judge's decision will be final and no correspondence will be entered into. The winners flight departs from, and returns to Sydney, the winner must travel to Sydney at his/her own expense. All entries become the absolute property of Dick Smith Electronics Pty. Ltd who may use such entries as they see fit.



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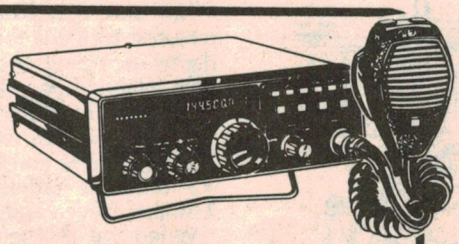

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AMATEUR RADIO

by Pierce Healy, VK2APQ

It's Jamboree-On-The-Air time again!

This month's notes feature two events of an entirely different nature, but which are linked by the common theme of amateur ratio in community service. One is the forthcoming JOTA, and the other a natural disaster and the part played by amateur radio.

Thousands of young people throughout the world will spend the weekend October 18/19, 1980, exchanging goodwill greetings. This unique activity, Jamboree-On-The-Air (JOTA), is made possible through the medium of amateur radio. It is perhaps the best known example of service to the community by amateur radio operators.

The event allows members of Scout and Guide organisations around the world to learn, at first hand, about the life-style, personal interests, and activities of people in other parts of the world.

It is not a contest but an opportunity, by means of the amateur radio service, to make contact with others having incentives fostered by Scout and Guide organisations.

Amateurs wishing to participate should invite local Scouts or Guides to visit their station or arrange to set up a station at a Scout or Guide hall or camp. Many Scout groups have their own amateur stations but need licensed operators to operate the equipment.

Each station may select its own operating periods. Suggested starting time is 0001 local time Saturday 18, terminating 48 hours later at 2359 Sunday October 19. Local amateur regulations must be adhered to.

Official world Scout phone calling frequencies are:– 3.590MHz; 7.090MHz; 14.290MHz; 21.170MHz; 28.590. Call "CQ Jamboree" on any of the above frequencies and, when a contact is made, move to another, nearest available, frequency.

The Australian opening ceremony will be transmitted through VK1BP from the grounds of Government House, Canberra, on Saturday October 18, 1980 commencing at 2.00pm local time. Frequencies for the opening ceremony will be 7.090MHz, 14.290MHz, and 21.170MHz. It will be appreciated if those frequencies are kept clear from 1.30pm until the conclusion of the opening ceremony.

Timetable for the opening ceremony will be:– 1.30pm: VK1BP will use each of the nominated frequencies to contact official branch Scout and Guide stations which will be calling in after the official addresses.

1.55pm: Late announcements regarding official JOTA ceremonies.

2.00pm: The official opening ceremony will commence with an address by His Excellency, The Chief Scout, Sir Zelman Cowen. He will be followed by an address to the Girl Guides by Her Excellency, Lady Cowen, who is president of the Girl Guides Association in Australia. Supporting addresses will be given by Dr Norman E. Johnson, Chief Commissioner for Scouts in Australia and by Mrs Charlotte Renshaw-Jones, Chief Commissioner for Guides in Australia.

At the conclusion of the addresses the nominated official stations from each state will be invited in turn to report on reception and present their respects to their Excellencies.

World Scout Station: This year, the World Bureau station will be operating from the United Kingdom, and the operators will be G3BHK and HB9AMS. The station will be at The Rutherford and Appleton Laboratories, near Windsor Castle, Berkshire. It is anticipated that the call sign will be GB2WSB.

Reports: The activities of all stations participating in Australia should be recorded and a copy sent direct to the National Organiser, JATO, Commissioner Neol I. Lynch VK4NKP/4ZNI, 15 Noeline Street, Dorrington, Qld 4060, not later than November 30, 1980.

It is expected that a Queensland Rover Scout, Kevin Campbell, currently at Mawson Base in the Antarctic, will be operating as near as possible to the official Scout frequencies under his call sign VK0KC.

Amateur Radio Weekend

To assist Scouts, Guides, and others who may be studying for the November, 1980, novice exam, or those seeking an introduction to amateur radio at an academic level, a radio weekend has been organised to coincide with the JOTA.

Period: Friday October 17, 1980, at 8.00pm until Sunday October 19, 1980, at 2.00pm.

Location: Camp Carey, Lawson New Road, Wentworth Falls, NSW, in the Blue Mountains. It is a 1.5km walk from Wentworth Falls railway station.

Arrangements have been made for those with young families. Fees, covering all food and accommodation, are: Children under two years – $2; two to four years – $7.50; full-time students and instructors – $18; others $22.

If you would like to attend, or help to instruct newcomers to amateur radio, contact – Craig Robinson, VK2PDF, PO Box 35, Croydon NSW 2132. Telephone (02) 74 0316.

Indian Disaster August 1979

A disaster which befell the 70,000 inhabitants of Morvi, a small isolated town about 470km north west of Bombay, India, rated only casual mention in our local news media. It was not until the September 1979, issue of the Federation of Amateur Radio Societies of India magazine, "Radio", arrived (surface mail) late in July, 1980 that the extent of the disaster, and the role Indian amateurs played in subsequent relief work, became known.

Although rather belated, this brief summary of events pays tribute to the initiative of amateurs in Bombay and their efforts in assisting relief authorities.

So devastating was the disaster that it wiped out all telephone communication

AMATEUR RADIO

virtually instantaneously, and it was 24 hours before small towns as close as 10 to 15km, and Rajkot 70km away, were even aware of the tragedy.

The disaster was preceded by 24 hours of very heavy rain which flooded the Machchu River. Just above Morvi is the Machu Dam No. 2 with a 58m high spillway and earthen embankments. The flood burst these embankments and, at 3pm on Saturday August 11, 1979, a 12m wall of water, driven by 50km/h wind, descended on Morvi. It destroyed 70% of the buildings and killed 10,000 inhabitants.

In Bombay on August 15, realising that communications could be a major problem in relief operations, members of the Federation of Amateur Radio Societies of India held a meeting, along with the Radio & Electronic Society of India, to plan assistance for relief work agencies.

Being totally unprepared for amateur radio to be involved in such emergencies, equipment was borrowed from amateurs in Bombay. Within three days a small party flew, unannounced from Bombay to Rajkot, where a station was initially set up in a hotel room, to demonstrate amateur radio and offer their services to the District Commandant of the Home Guard, in charge of relief operations.

A midnight meeting with the District Commandant was arranged by a Rajkot amateur. A comment on that meeting by the Commandant was – "We were so delighted to meet them and were relieved of some of our anxiety. We started work immediately." One station was established at the Rajkot Home Guard Headquarters, and another at Morvi in a small tent in a high school garden, both as HF base stations.

A Home Guard jeep was made available and fitted with a HF transceiver and a two-metre FM unit. A hand held two-metre FM unit was used for contact with working parties in areas which could not be reached by jeep. Each day required a return trip (70km each way) between Rajkot and Morvi, starting at 8.00am and returning at 1.00am next day, it not being possible to remain in Morvi overnight.

Operation under these harsh, makeshift, conditions continued for 18 days. During that time at least 50 official messages a day were handled between Morvi, Rajkot, and amateur stations in towns and cities where relief activities were being organised. The unofficial messages handled for the several relief organisations, including those for locating missing persons, were too numerous to be recorded. Radio communication was maintained for about 18 hours daily.

Photographs accompanying the stories in "Radio" magazine gave a horrifying indication of the shocking nature of the tragedy. Further comment by the Commandant summed up the appreciation for the amateurs' assistance. "It is impossible to express my gratitude to them and it is impossible to find correct words in which to thank those friends.

"It was the first time I could see what amateur radio can do and, with this experience, I can say with confidence that in any disaster and in any calamity, natural or man-made, these friends from FARSI can be an asset to relief work or any other operation.

"A real patriotic and national service which, if utilised properly, can be an asset to this great nation."

From reports, it appears that the Home Guard is similar in structure to local Australian civil emergency groups, but not equipped for such a large scale emergency, and with limited VHF radio equipment. Prior to the participation by amateurs it was necessary for all messages between Morvi and Rajkot to the taken by jeep.

This is a very brief summary of amateur participation. To appreciate their efforts it is necessary to realise that although India has an extremely large population, there are only about 1000 amateurs in the whole country; most of them without access to modern commercial equipment.

Having been their guest in Bombay a decade ago when the FARSI was formed, I (VK2APQ) can appreciate their dedication to amateur radio and community service. Many of the call signs mentioned revived memories of pleasant "eyeball QSO's".

Remembrance Day Contest

The opening address for the 1980 Remembrance Day Contest was given by the Minister for Post and Telecommunications, the Hon A.M. Staley, during which he announced a significant amendment to Australian amateur radio regulations. Mr Staley's words were: "It was with a great deal of pleasure that I received your invitation to open the WIA Remembrance Day Contest.

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AMATEUR RADIO

"Since becoming the minister for Post and Telecommunications I have enjoyed close relations with the Institute. Indeed the aims and ideas of the Institute seem to be embodied in the contest itself.

"The contest is dedicated to the memory of amateurs who laid down their lives in defence of their country during World War II. Personally I can think of no better way in which they would have wished to be remembered.

"This contest is also renowned for its friendliness and fellowship. In fact, I understand, it is sometimes referred to as the 'friendly contest'. The form of the contest not only demonstrates the very high degree of skill that amateurs have achieved, but also shows the way in which such skills can be used for their fellow man in times of national or international emergency.

"Here we have a contest founded to commemorate sacrifice and duty, renowned for its friendliness and fellowship, and in its format encouraging the development of communication skills. This event not only permits experienced amateurs to demonstrate their expertise but is also an extension, for the more inexperienced amateurs, of the excellent training offered by the WIA to its members.

"Let me take the advantage of the opportunity presented in opening your 1980 contest to also mention some issues currently under discussion between the Institute and the Government:

"First I am very pleased on this occasion to announce that the long standing prohibition on the use of third party traffic by amateur radio operators will be removed for non-commercial messages. As you will be aware, the WIA presented their submission for a restricted form of third party traffic in 1977. Since that time there has been considerable discussion on this matter between my department and the WIA.

"There is no reason why this privilege may not be provided forthwith in Australia. But before any international traffic can proceed in this way we must await the agreement of the countries concerned. At this stage it appears likely that only the United States may agree. My department will continue to discuss such aspects with the WIA.

"Certain legislative changes will, of course, need to be made to Wireless Telegraphy Regulations. In the meantime the conditions under which third party traffic will be permitted will exclude certain forms of radio communication, mainly involving communications for the purpose of material gain such as advertising. I will take the necessary steps to ensure that all bodies concerned with this change will be advised in writing and the required legislative change will be made as soon as possible.

"Second, I have agreed to the proposal made by my department which is to produce a draft of the post WARC Australian radio frequency table in consultation with all interested parties, including of course the WIA itself. So I hope you will all see a copy of the draft table within the next few months.

"I am sure you are all anxious to begin your contest and I have much pleasure in declaring the 1980 Remembrance Day Contest open."

Heard Island DX Association

Progress towards amateur radio activation of Heard Island is making headway. The situation at the beginning of August, 1980 as reported by John Smith, P29JS, is that the government department has advised that there is no objection in principle to the project, but a number of conditions must be met.

An amateur licence has been issued, call sign VK0JS. An amount around $800 has been donated to the fund to cover expenses.

Negotiations are under way to charter a suitable vessel, this being the main expense.

A minimum stay at Heard Island of 14 days is anticipated with a team of six experienced operators. Plenty of help is required to ensure that this rare DX area is to be activated early in 1981.

For further details write to Heard Island DX Association, PO Box 2053, Konedobu, Papua New Guinea.

SWARS Convention

The NSW South West Amateur Radio Society convention will be held at Griffith on the weekend October 25/26, 1980.

A wide range of competitions, trade displays, demonstrations and tours through wineries have been arranged. Contests will start at 8.00am on both Saturday and Sunday.

There will be an official dinner on Saturday evening which will progress into a social night.

Accommodation should be booked early. The event will cater for the whole family.

For further details write to Heard Wednesday evening at 8.00pm around 3610kHz. Call sign VK2DEI. Secretary, Graeme Watkins, VK2DGW, 91 McArthur Street, Griffith NSW 2680.

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

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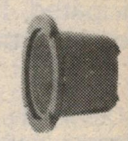

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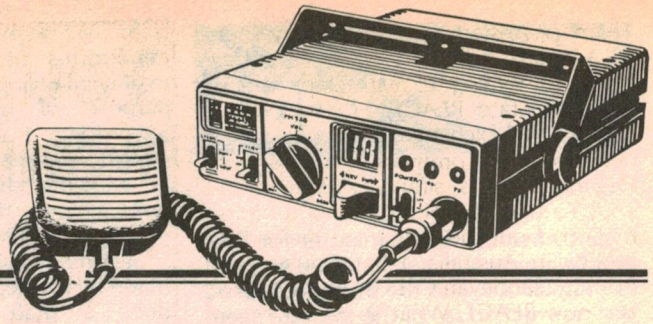
The Australian CB SCENE



INTERVIEW WITH P&T MINISTER STALEY, BUT . . .

During August, The National Director of the NCRA, Terry Watkins, and I had our eagerly anticipated meeting in Brisbane with Mr Tony Staley, the Minister for Post and Telecommunication. What we had not anticipated, however, was his earlier announcement that he would be retiring from politics and, of course, from his ministerial post.

Despite the personal stress that such a decision must have entailed, I found Mr Staley to be a very easy person to talk to and the atmosphere was one of complete relaxation. Apart from a few minutes spent talking politics, the rest of the time was devoted to CB related matters.

I would take this opportunity to express my personal regret at Mr Staley's retirement from politics at the next elections, and to wish him and his family all the best in whatever they do. I have found him to be a most capable Minister, and the CBRS has indeed benefited by having him handling the P&T portfolio.

Throughout, the talks were informal, and there were no earth-shattering revelations. That was to be expected, in the light of the forthcoming public inquiry. If we had expected any arguments relating to the NCRA submission, we were pleasantly surprised in finding him sympathetic to the Association's views. All the points, which we had made, had been underlined by the Minister for consideration by the inquiry. Those which the Minister wasn't quite certain about were discussed – in particular the matter of overseas communications.

We asked him what was being done about restricting the importation of illegal CB equipment. He said to us that action was being taken and that he would soon be making a media release about it. He is as concerned about the problem as we are.

The Minister echoed the feelings of the NCRA when he said that, together, we had brought great improvements to the CBRS. While we have always acknowledged the things which he has done, it was indeed heartening to hear the Minister, albeit in private, also acknowledge the work done by the NCRA.

Mr Staley told us that a paper for comment would be issued after the inquiry. He urged us to make further submissions to that, if we were not happy with the results, and to keep "the pressure" up on his successor. It was easy to promise to do so, as that is the reason that the NCRA is in existence!

NEW FRIENDS: During the CREST National Council meeting, held in Brisbane recently, I had the pleasure of meeting Jackie Brown, one of the Tasmanian delegates. Over the course of the weekend we got to know each other very well. Subsequently I received two letters from Jackie, one being a Thank You card, and the other containing a copy of the Burnie CB Club newsletter, which she and her husband compile. The newsletter is very well put together and I look forward to seeing more of them. My thanks to both Jackie and the BT club.

MAIL BAG

VICTORIAN UHF CLUB: I have received a further letter from Max Morris of the Victorian UHF club thanking me for mentioning them in my column and advising me that, because of it, they picked up their first WA contact. I hope that there have been many more since then. Max also included a breakdown of the club's submission which I found most interesting. The club is understandably concerned about the rising commercial use of 476-477MHz, and I share their concern. Lets hope that this is soon changed. Thanks for writing again, Max.

FORMER CBer: I acknowledge also a letter signed just "X-CBer". One part reads as follows:

"Generally I ignore articles written tongue-in-cheek, realising that they are only written, stating what is expected of them. But, of late, there have been a number of articles like yours and even an Editorial viewpoint re pirates. I must reply.

"You very pointedly say that a pirate is not a CBer but, on the opposite page, you are making verbal hay about the fight for lifting the restrictions and oppressive rules and regulations in force at this time. Do you mean a "bad" boy on .335 today is a pirate but, Telecom or God willing, is a good CBer tomorrow if 40 channels are approved?"

First, lets get our definition straight: A pirate is someone who works out of band. Nothing more, nothing less. If a person is using 27.355MHz now, then he IS a pirate. When 40 channels are legally available, he will no longer be working out of band, hence no longer a pirate. But should he then decide to operate on say 27.555MHz, then he would obviously become a pirate again. Surely that is logical.

Secondly, the fight is, first and foremost, for the retention of the 27MHz Service. After that comes the expansion and improvement of it. If we don't win the first one, everyone on the band will be pirates!

Thirdly, I concede that, as "X-CBer" states (further on in his letter) the majority of pirates are fairly good operators, but that doesn't change a thing. They are still breaking the law. Now lets come to our senses, for goodness sake. If the law is wrong, don't break it. . . change it. If you want the law changed, get behind the people who are trying to do so, like the NCRA.

After all that, "X-CBer," thanks for writing. I hope to hear from you again.

WARATAH STATE REACT: A pleasant surprise landed on my desk the other day in the form of a letter from Waratah State (NSW) REACT. The letter originates from Mr Geoff Stokes, the State President of REACT. The initials stand for Radio Emergency Citizens Team, being affiliated with REACT in the United States. REACT differs from CREST, apparently, in that they provide for mobile as well as base monitoring. Geoff states the aims of REACT as follows:". . . of assisting CREST, the general motorist and the CBer both on the air and off."

Waratah State REACT commenced operations in Sydney on August 4, 1979, and presently has 27 monitors in that city. They are looking for more monitors, and anyone wishing either to join the

Team, or to start another one anywhere in Australia will get all the help they need by writing to Mr Geoff Stokes, Waratah State REACT, PO Box M447, Sydney Mail Exchange, 2012.

My general comment on Emergency Organisations is simply... Where are you? To date, despite my plea for information about the numerous monitoring groups in Australia, I have only heard from Queanbeyan CREST, Mackay CREST and now REACT. What about the rest of you? Here is a golden opportunity to tell the rest of Australia what you are doing through the pages of a popular national magazine. The ball is in your court...

A CBer WITH A PROBLEM

A CB Coffee Break was held in Brisbane to try to raise money for a tiny bundle of dynamite named Tina, who suffers from Multiple Sclerosis. Tina is a member of the channel five monitoring group Brisbane ACRM, and was the driving force behind the group's participation in the recent Brisbane television station BTQ 7's Childrens Hospital Appeal Telethon. Not only did Tina organise ACRM's participation, but she also spent most of the duration of the Appeal at BTQ 7 studios running around all over the place doing the work no-one seemed to want to do.

Immediately after the Appeal ended (CB operators, by the way donated over $6,000 to it) Tina suffered another attack of MS which her doctors contributed directly to her efforts at BTQ 7. She lost all feeling in her legs and suffered further damage to her already impaired eyesight. Tina is now undergoing acupuncture on an experimental basis to try to halt the disease. If it succeeds with her it will be tried on other MS sufferers.

The treatment however is expensive and not covered by the NHS or Medibank. Rod Fewster of Queensland Scene ("CB Action") asked Terry Watkin and myself (NCRA) to help raise money for her; hence the Coffee Break. It was held over a 12-hour period, and we managed to raise $300 for her. I would take this opportunity to thank the local firms whose donations assisted in achieving this amount.

The day could have been a lot more successful had we had media support. With the exception of small pieces in the Courier Mail and the Telegraph, the media didn't want to know. What the Brisbane CB operators are hopping mad about is the fact that BTQ 7, the channel which Tina knocked herself out for, didn't even give the Coffee Break a mention. The ironical thing is that BTQ 7 has intimated that it would like ACRM's help again next year for its Appeal!

Well, that's it for this month. Keep those letters coming in, and I promise to use as many each month as space permits. My address, as always, is Australian CB Scene, PO Box 406, FORTITUDE VALLEY, 4006.

JAN CHRISTENSEN

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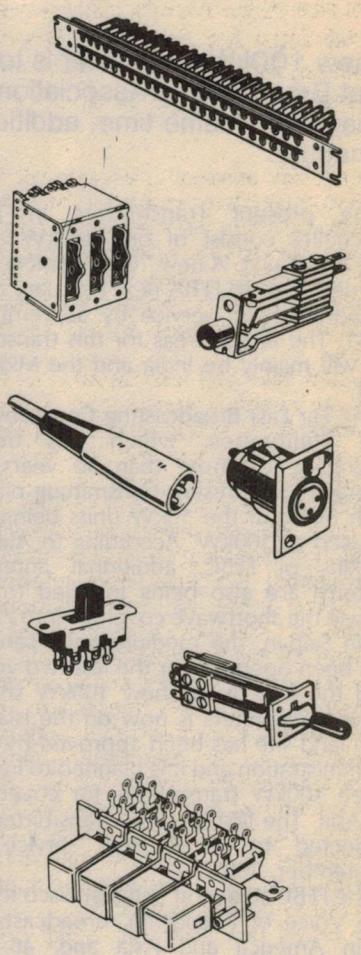

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SHORTWAVE SCENE

by Arthur Cushen, MBE

FEBA, FEBC install new transmitters, antennas

A new 100kW transmitter is to be installed on Seychelles for the Far East Broadcasting Association to expand its gospel broadcasts into Asia. At the same time, additional languages are to be added to the schedule.

The present transmitters in the Seychelles consist of one 100kW and one 25kW unit. A new 100kW unit is being delivered to FEBA next February and it should be in service by September, 1981. The target areas for this transmitter will mainly be India and the Middle East.

The Far East Broadcasting Company in the Philippines, which has been operating for more than 30 years, is upgrading its present transmitting plant, with many of the 50kW units being increased to 100kW. According to Alister Perkins of FEBC, additional antenna systems are also being installed to increase the shortwave coverage into Asia.

On Saipan, the medium-wave service has been operated for the last two years and the first of the new 100kW shortwave transmitters is now on the Island. The land site has been approved by the Administration and it is planned to install three 100kW transmitters for coverage of Asia. The first of these transmitters is expected to come into service in September, 1981.

The FEBC station at San Francisco KGEI, the Voice of Friendship, broadcasts to Latin America and Asia and, at this transmitting site, a new antenna is being installed for Russian broadcasting. It will be a curtain antenna and will send the signal North over the Pole and into Central Siberia. It can be electronically slewed to cover Western Russia or the Eastern Siberian area.

The other FEBC installation is in Korea and consists of two medium-wave stations. One, of 250kW, is on Jeju Island and recently had a call change from HLDA to HLAZ. The call change was at the direction of the Korean Government because of some confusion in the designation. The station operates on 1566kHz, while a second station HLKX operates on 1188kHz from Inchon. The transmissions of HLAZ have been heard as far west as Moscow, while considerable mail is being received also from the Tibetan area.

Some indications of the intense interest of gospel radio and shortwave broadcasting in general is received in mail at the Far East Broadcasting Company offices in Hong Kong. Like most international broadcasters, there has been a tremendous mail response from China. Ten years ago, mail was being received on an average of 18 letters a year. In 1979 it increased to 11,000 letters and in April, 1980 over 1000 letters were received during that month alone from Chinese listeners.

Conscious of the interest in learning English by the Chinese population the FEBC programs which can be heard in China have been increased, not only in Chinese but in the English language.

RADIO NEW ZEALAND

Radio New Zealand External Service will introduce a new schedule from October 25, when the country moves into daylight time 13 hours ahead of UTC.

The programs of Radio New Zealand are a relay of the internal service, so each program will be heard one hour earlier (UTC) on short-wave, because the transmissions are not altered to suit the change in local time. The new schedule shows the use of three out-of-band frequencies. The broadcast to the Pacific and North America is 1700-2005UTC on 9890 or 15485kHz; 1700-2145 11675; 2015-0715 15485; 2150-0530 17860; 0540-0930 11945. To Australia 0730-1115 11945; and 0945-1115 on 6105kHz.

COLOMBIAN SIGNALS

Radio Neiva has been again heard on 4855kHz after a period in which the signals were seldom reported. The station opens around 0930UTC and has also been heard in New Zealand closing at 0500UTC. Two other signals have been observed. La Voz de la Selva on 6170kHz has been heard around 0900UTC when operating all night, but not on a regular basis; Radio Super de Cali on 6085kHz has been observed with their all night transmission giving best reception at 0800UTC.

Latin American signals continue to be well received in South Australia and transmissions from Colombia have been observed by Simon Tuck, reporting in DX Post. These include Radio Sutatenza on 5075kHz heard at 1002UTC, while Don Mitchell reports the same station on 6075kHz at 1040UTC. On 6040kHz Simon Tuck reports the reactivated La Voz del Tolima, heard around 0950UTC with classical music.

HIGHER POWER FOR KTWR

Radio KTWR at Agana, Guam, has announced that its present two 100kW transmitters will be increased to four early in the New Year. The station has had difficulty in serving the Asian area with a simultaneous two-language service, while difficulties in reaching areas to the West of Guam have also been encountered.

This Trans World Radio station opened in 1977 and the transmitter building is currently being enlarged. The new transmitters will be identical to the two Harris units at present installed. The station currently uses two curtain antennas which can be slewed plus or minus 30° from the centre bearing. Two additional antenna systems similar to the present ones will be installed for use with the new transmitters.

Trans World Radio is an international, non-profit missionary organisation utilising transmitters with a combined power of more than 5,000,000 watts to broadcast in more than 80 languages from facilities in Monte Carlo, Bonaire, Swaziland, Guam, Cyprus and Sri Lanka.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

SHORTWAVE SCENE

KTWG, Trans World Radio's medium-wave station on Guam, is broadcasting with 10kW from 2000-1400UTC daily on a frequency of 800kHz.

The address of KTWR is PO Box CC, Agana, Guam and the transmission best received in Australia is 0745-0930UTC on 11840kHz with DX Listeners Log on Fridays at 0915UTC.

HIGHER POWER FOR KADUNA

The Regional Station at Kaduna, Nigeria has been heard on 4770kHz from around 0500UTC and again at 2000UTC. This station has news at 0600 and is using power of 50kW with some programs relayed from the Federal Radio Corporation of Nigeria at Lagos.

According to the BBC Monitoring Service, Kaduna states that it now transmits on 4770kHz with a new 50kW transmitter, 6090kHz with a 250kHz transmitter and on 9570kHz with 50kW. The Kaduna centre broadcasts its own local programs, but occasionally joins the Federal Radio Corporation of Nigeria at Lagos for the 2100UTC news bulletin. Lagos transmits on 4990kHz.

This photo, taken at the recent National Convention of the New Zealand Radio DX League in Auckland, shows four blind radio listeners (left to right): Shirley Lansink, Barry Jones, Arthur Cushen and Douglas Doull. Radio listening by the handicapped will be promoted during 1981 – the Year of the Disabled.

LISTENING BRIEFS

AFRICA

COMORO ISLANDS: The present schedule of the External Service on 3331kHz is 1500-1600 Arabic, 1600-1700 English, 1700-1900 French and 1900-2000 Swahili. The National Service is broadcast on medium-wave 1275kHz and on short-wave on 7260kHz. According to Sweden Calling DXers, Reg Holway has received this schedule; there are indications that the National Service is also on 7260kHz with French at 1000, followed by English at 1015UTC.

AMERICAS

MEXICO: Radio Mexico announced recently that, with the help of engineers from the German Democratic Republic, Mexico would build a short-wave broadcasting centre at Oxaltepec, 50km from Mexico City. The BBC Monitoring Service Report stated that German Democratic Republic would co-operate in the planning of the project, the supply of transmission and communications equipment and the training of technical personnel.

ASIA

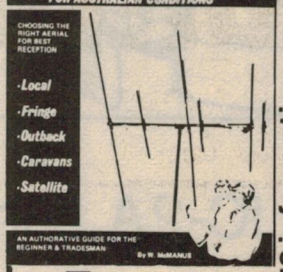
BANGLADESH: Radio Bangladesh is now using 21770kHz for its broadcast to Europe 1230-1300UTC. This frequency replaces 21690kHz; another channel, 15285kHz carries the same program.

INDONESIA: The Indonesian Government have announced a loan from France to purchase high power transmitters to improve the international service. At present Radio Republik Indonesia broadcasts in nine languages and the upgrading of the facilities would enable Indonesian Embassies abroad to hear broadcasts from Jakarta. Radio Republik Indonesia has been heard recently on 15200kHz with English at 0800UTC.

EUROPE

SWITZERLAND: Berne is now using a new frequency of 17850kHz in place of 17760kHz for the period 1815-2245UTC. The same program is on 15125, 17830, and 21585kHz with English 1815-1845UTC.

TV & FM AERIAL INSTALLATIONS
FOR AUSTRALIAN CONDITIONS



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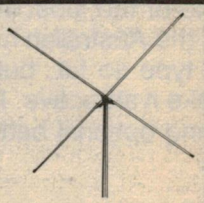

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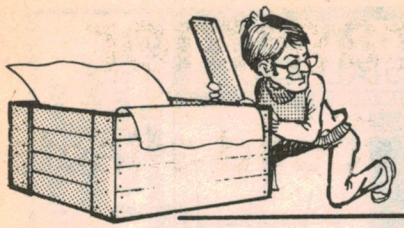

NEW PRODUCTS

ICOM IC-2A hand-held 2-metre transmitter

One of the most intriguing hand-held two-metre transceivers to appear on the Australian market is the ICOM IC-2A. Not only is it the smallest of its type so far, but also one of the cheapest, and these factors alone make it attractive. In addition, it offers RF power outputs of up to 5W, using optional battery packs.

The IC2A designers have obviously aimed at simplicity, with its advantages of small size, light weight, lower cost, and high reliability. In doing so they have settled for a basic unit, omitting the more glamorous features such as programmable memories, scanners, etc, while retaining the main features to be expected in a set of this type.

For those of us who can struggle along without scanners or memories, the result is an excellent compromise. The set provides the full 4MHz coverage of the Australian two-metre band in 800 (5kHz) steps, with 600kHz positive and negative repeater offsets.

Channel selection is by means of three easily operated and clearly marked thumbwheel switches, and one auxilliary switch. The thumbwheel switches select the last MHz digit, the 100kHz digit, and the 10kHz digit, with the auxilliary switch providing a 5kHz upshift. Such a system is independent of the set's power supply.

For repeater operation the receiver frequency is selected and the transmitter frequency offset as required. Two small switches on the back of the set select either "Simplex" or "Duplex" and "+600" or "−600" respectively. Anti-repeater operation is also possible.

In short, the system can cope with any current simplex or repeater situation, or any likely band-plan expansion in the foreseeable future.

One of the most attractive features of this set is its small size. With a standard battery pack it measures 155mm (H) x 65mm (W) x 35mm (D), and weighs 490g. It will sit quite snugly in the breast pocket of a coat or overall, and deliver a more than adequate audio signal from such a confined space.

Another feature is a versatile battery pack arrangement. As supplied, the set is fitted with a clip-on pack of seven shortened "AA" NiCa cells, delivering 8.4V with a capacity of 250mAH. (The standard "AA" NiCa cell is 450mAH.) This pack contains a charging circuit which allows it to be charged from any 12 to 15V source, such as a car battery or power supply, and a suitable power supply comes with the set.

With this battery pack the set will deliver 1.5W of RF, but there are two other battery packs which give increased power output. One, expected to be available shortly, is fitted with nine NiCa cells and gives 2.3W output.

The other pack is not yet available but, apparently, delivers about 16V and boosts the RF output to 5W. More details should be available shortly.

There is also a six cell pack, for alkaline cells, which also gives 1.5W of RF. This pack can be fitted with NiCa cells, and used as a spare, but RF output is reduced to 1W.

The set has jacks for both an external speaker and an external microphone. Both are particularly valuable in a vehicle, allowing a larger, conveniently located speaker and separate microphone to be used. The microphone circuit requires only a two-conductor cable for both the signal and press-to-talk circuits.

Circuits are given showing how either a dynamic or electret microphone should be wired, and a suitable plug is included in the accessories. An external speaker-microphone is one of the extras which should be available shortly.

Internally the set is, as one would expect, very compact. It is constructed on two printed boards, sitting back-to-back, and mounted in a hinged frame. This allows them to be swung open, book fashion, so that both sides of each board are accessible.

The receiver is a double-change superhet, with a first IF at 10.7MHz and the second IF at 455kHz. Sensitivity is given as less than 0.5uV for 20dB quieting, and the selectivity as less than +/−15kHz at −60dB. In use, these figures would appear to be fully substantiated and, in fact, the receiver performance is most impressive.

Fed into a power output meter, the transmitter delivered the rated 1.5W. On the air, a session with a unit like this provides an impressive reminder as to just how effective 1.5W of RF can be in the two-metre band, even when using the short flexible antenna supplied.

Both Sydney repeaters could be worked from any reasonable location in the metropolitan area, and even from some not so good ones. In poorer locations substituting the quarter wave whip on the car provided a very significant improvement. We also made some very interesting – and some quite remarkable – simplex contacts using the flexible antenna and only 150mW of RF.

The instruction manual contains a few quaint phrases, but all instructions are quite clear. It also contains a comprehensive voltage chart for all transistors, a large fold-out circuit, and a block diagram.

The set comes complete with the battery charger, flexible antenna, belt clip, earphone, earphone and microphone plugs, and a hand strap. The recommended retail price is $299.00.

In summary: a very attractive set at a very reasonable price.

(For further information: Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne. Phone 03 699 6700).

Victory Home TV Programmer

... has plug-in cartridges, colour & sound effects

The "Victory" Home TV Programmer from Soundic is a video games unit based on the COSMAC 1802 microprocessor. It offers a range of games and amusements for one or two players, in full colour, and with sound effects. The unit connects directly to a television set, and is capable of providing hours of entertainment and instruction.

The Home TV Programmer is attractively presented in a black and grey plastic console measuring approximately 375 x 170 x 65mm. As can be seen from the photograph, the console consists of a front panel with the prominent "Clear" button, a slot for inserting cartridges programmed with various games, and two recesses which hold the keypads. The numeric keypads can be detached from the unit and held in the hand, with almost a metre of connecting cable between the console and the keypads.

Buttons on the keypads are used for the control of movement, colour, and sound while playing the games. The unit also comes with two joystick controllers which clip in place over the keypads. Movement of the joystick then causes studs on the underside of the controllers to contact the buttons of the keypad, giving a more convenient way of controlling movement on the screen. Because of the mechanical arrangement of these joysticks however diagonal movement is not possible, whereas it is available by pushing the appropriate button on the keypad.

The Victory Home TV Programmer is similar to the Fairchild Video Entertainment Centre which we reviewed in December 1978. Like the Fairchild game it offers a selection of games in pre-programmed plug-in cartridges and twin hand controllers. However it has features which the Fairchild game lacked, such as a larger number of built-in games, a wider choice of colours which can be displayed and numeric keypads. It is also considerably cheaper than the Fairchild unit.

Because it uses a CMOS processor, the games unit can be powered from a 6V plug pack or battery eliminator. The COSMAC processor is fairly slow, however, and the task of driving the video display further reduces its speed. This means that some of the games tend to lack excitement because everything happens so slowly.

The Home TV Programmer interfaces directly to a television set, with both video and sound signals fed to a VHF modulator and input to the antenna terminals of the set. The game we reviewed was set up for operation on Channel 1.

Without a cartridge inserted the machine provides four games. The first of these, called "Doodle" is an excellent example of the capabilities of the system. The program transforms a colour TV set into an electronic "canvas". At the start of the program a white dot appears at the lower left hand corner of the screen. The user can set the colour of the dot by pressing keys on one keypad, and control the movement of the dot by keys on the other keypad to draw lines. Each key on the pad used for changing colours also generates a musical note as it is operated. Other keys provide for erasing and re-writing lines.

The second game, "Patterns" is similar, except that once a pattern is formed it is stored in memory and automatically repeated, along with the musical notes generated as the colour of the pattern changes. With a bit of practice it is possible to create very pleasing designs in eight colours, and have them repeated endlessly, along with the music created by the changing pattern. Up to 128 key entries can be stored in memory, allowing intricate patterns to be created.

Also built in is "Bowling", a representation of ten-pin bowling for two players. Each player takes turns at controlling the path of a ball which can be directed to strike the pins. The games unit automatically displays the score for each player and keeps track of the number of frames played.

The fourth game provided by the basic unit is Blackjack, which may be played as either a one or two person game. The machine displays each player's total stake in the game and asks the players to cut the cards and bet. Players can then draw other cards or pass, attempting to beat the dealer (the games unit). Winnings are automatically added to the player's total stake and losses deducted and then a new hand is dealt. You can break the bank by increasing your winnings to $999.

These four games, with sound and colour graphics, are in themselves excellent value, and would be a selling point even if no other games were available with the unit. As it turns out however they are just the beginning. . .

At the moment there are 13 plug-in cartridges available, with a number of them containing two games. "Spacewar/Intercept", the first cartridge to come to hand, is a variation on the UFO and missile theme. Two versions of the game are available, again for one or two players. A good sense of timing and a steady hand are necessary to launch the missile at the appropriate time and steer it onto a collision course with the moving target. Players take turns, in which case the games unit computes and displays their scores, or the game can be played solo.

The "Star War" cartridge, based on the movie of the same name, involves manoeuvring spaceships around on the screen and attempting to frame your enemy in the viewfinder of your automatic weapons system. A musical note tells you that you have succeeded, followed by a gratifying visual display as the enemy ship explodes. Another version of the same game allows two players, one the pursuer and the other the pursued – but be careful, because the roles can be easily reversed!

Other cartridges available include:

(continued on p98)

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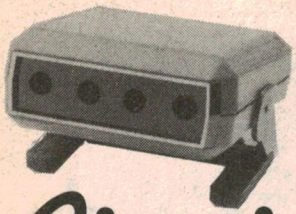

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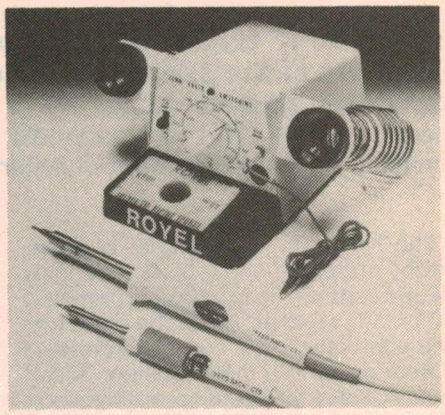


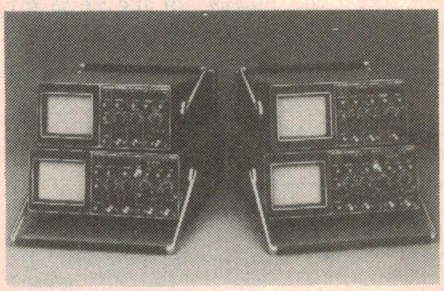
Royston Electronics now have available the Royel ECT controlled-temperature soldering station which incorporates a number of innovative features. The control unit accepts either of two soldering tools, the CT6 with a 3mm tip diameter, or the CT7, with 5mm tip. The tool rest is mounted on the side of the controller, allowing the soldering iron to idle at the selected temperature indefinitely. A second rest can easily be mounted on the other side of the cabinet to allow the use of two soldering tools.

The power unit contains a transformer to supply low voltage to the soldering tools, and tip temperature is selected by an infinitely variable, direct reading dial. The unit also provides a temperature lock to prevent unauthorised adjustment and a programmable detent which allows for the selection of predetermined intermediate temperatures.

To eliminate voltage transients the controller uses zero voltage switching. The tip of the iron is held at zero potential, and an auxiliary ground connection is provided for use when necessary, helping to prevent damage to static-sensitive components.

Further enquiries should be made to Royston Electronics, 27 Mormanby Road, Notting Hill, Vic 3168, or 15/59 Moxon Road, Punchbowl, NSW, 2196.

New 35MHz oscilloscopes from Philips



Two new 35MHz oscilloscopes from Philips Test & Measuring Instruments, combined with Philips 25MHz oscilloscopes the PM3212 and PM3214, allow the user to choose the instrument which is best suited to his needs.

The PM3212 is a general purpose single-timebase oscilloscope for frequencies up to 25MHz. The PM3214 is a similar scope with a delay timebase. If the user requires a higher bandwidth, the new Philips PM3216 single-timebase or the PM3218 delayed timebase models can be used up to 35MHz.

The 35MHz models offer a maximum sweep speed of 10ns/cm, a sensitivity of 2mV over the full bandwidth and a Z-modulation input, which makes the new oscilloscopes ideal for the expanding number of logic-analyser applications.

With their wide range of power-supply options the new oscilloscopes can be used almost anywhere. In addition, an optional 24V battery supply is available.

More information can be obtained from Philips Test & Measuring Instruments, 25 Paul St, North Ryde, NSW, 2113.

Victory Home TV Programmer . . .

from p97

Concentration match; Schoolhouse II — Maths Fun; Speedway/Tag, Pinball; and Biorhythm. The last named cartridge is not a game, but instead computes and displays the user's biorhythms for a selected 32 days period.

Overall the Victory Home TV Programmer represents excellent value for money in the video games field. The unit is robust enough to take some hard knocks, and the numeric keypads and joystick controllers are well suited to the hands of children. The colours are a little lacking in saturation, and the unit does appear to suffer from interference, possibly because of the plastic case but neither of these problems is particularly annoying.

The Victory Home TV Programmer and cartridges are available from Radio Despatch Service, 869 George St, Sydney, NSW, 2001. Recommended retail price of the games unit is $95.50, including the joysticks and 6V power supply. The cartridges cost $20.00 each. (PV).

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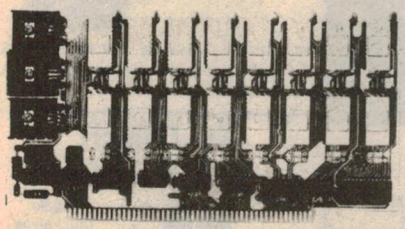

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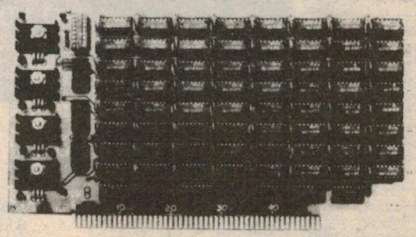

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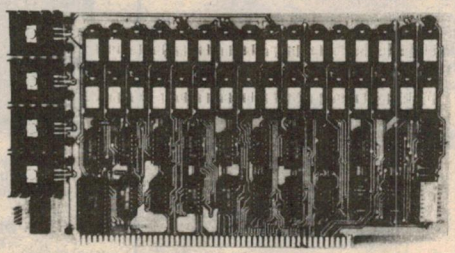

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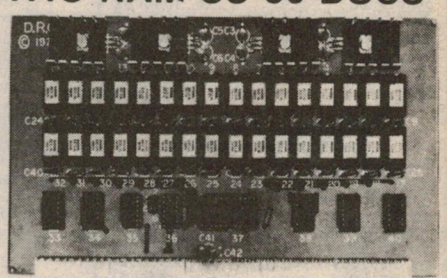

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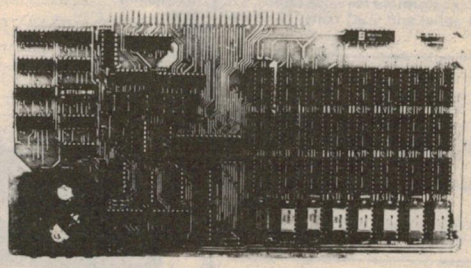

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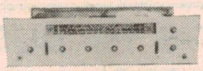

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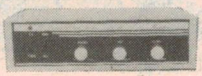

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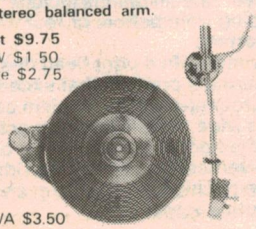

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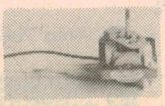

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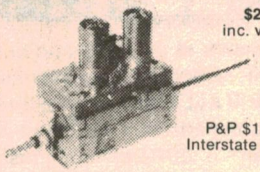

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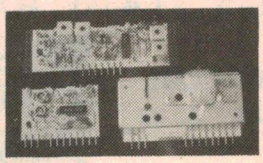

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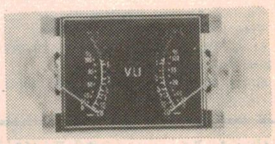

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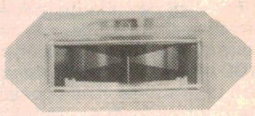

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Mathemagician: electronic maths tutor

RIGHT: Mathemagician comes complete with display overlay panels for different games, and an instruction manual.

Recently introduced by APF, the "Mathemagician" is a calculator-style "teaching machine" designed to teach arithmetic to young children. The unit measures 220 x 130 x 36mm and is packaged in an attractive plastic case with colourful display overlays so that different games can be played with the basic machine.

In addition to the usual arithmetic functions the Mathemagician can be used to check the answers to problems which a child has already worked out. For instance, a question can be input in the form 4 + 4 = 8, and on pressing the appropriate button the machine will activate a LED to give the message "That's right".

The Mathemagician will also give the correct answer if the child's answer is wrong.

The display of the Mathemagician uses 8mm digits and is easy to read. The addition sign and the seven-segment displays are unusually shaped, and perhaps could cause some confusion when used for alphabetic readout.

The Mathemagician will accept only 2-digit numbers, so arithmetic operations are limited to the range 0 to 99. Unlike a calculator the Mathmagician does not give answers in decimal point form, but indicates a remainder. The answer to "12 ÷ 5" is given as 2r2, for example.

There are six games which can be played with the Mathemagician. The first of these is to help young players develop number recognition skills. The machine briefly displays a number and then waits for the player to key in the same number. The second game develops counting skills.

Other games include "Gooey Gumdrop", in which the player has to track down an exploding Gumdrop on a 9 x 9 grid, moving in accordance with clues supplied by the machine, and "Lunar Lander", a version of the old favourite computer game.

The machine can also be set up to produce arithmetic problems and keep a score of the correct answers. One player can practise alone or two players can compete, moving on to harder problems as their skills increase.

The APF Mathemagician is priced at $36 including the plugpack AC adaptor. Special bulk prices apply for schools. Further information on the Mathemagician can be obtained from the Calculator Supermarket, 435 Bourke Street, Melbourne, Victoria.

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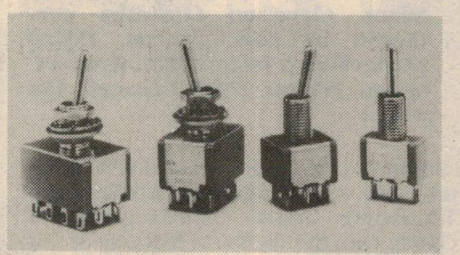

Philips Electronic Components and Materials have announced the addition of 3 and 4-pole miniature toggle and rocker switches to the existing range manufactured by Dialight of the USA. The 3-pole design has six switch functions and the 4-pole design has nine switch functions including provision for three-way switching. All of the switches can be supplied with solder, PCB or wire-wrap terminals, in two contact ratings for low and high level applications.

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BEETHOVEN, BRAHMS: Two sides of Maurizio Pollini

BEETHOVEN — Piano Sonata, Op 106 (Hammerklavier). Maurizio Pollini (piano). DDG Dolby Stereo Cassette 3300 869. Also on disc.

There have been countless really great performances of this sonata recorded over the years, both before and after the introduction of LP. Of the early ones, Schnabel's will perhaps remain the most famous, despite his occasional tendency to become what I have often described as a "biblical" pianist — never let your right hand know what your left hand's doing. (I hope I've got the quotation right!)

Some of the more recent outstanding performances to come to mind, all great in their own way, are Arrau's, Brendel's, and Kempff's. Yet here is one that can successfully challenge them all and come very close to defeating some. It is certainly the best to have been recorded in many years. To me Pollini seems to combine the good points of most of his rivals — the perception of Schnabel, the lyricism of Arrau, the masculinity of Kempff and so on.

His technique is more than adequate to dismiss as negligible the wide-spread, ferocious technical difficulties of the work. And to all these virtues he adds the exercise of quite wonderful control over the long sentences — or perhaps I should have written paragraphs, of the sonata. In the beautifully lyrical slow movement, he manages to capture to perfection the emotionally "falling backwards" throughout. And in the magnificent Finale his is undoubtedly the greatest performance ever recorded — and I don't care who you put up against it. If you're on the lookout for "historical" recordings here is one right under your hand. (J.R.)

☆ ☆ ☆

BRAHMS — Piano Concerto No 2 in B Flat. Maurizio Pollini (piano) with the Vienna Philharmonic Orchestra conducted by Caludio Abbado. DGG Stereo Cassette 3300 790. Also on disc.

I was not so happy with Pollini's performance of this great work. Compared to the massive masculinity of his Hammerklavier mentioned above, there is a curious air of femininity about his interpretation of this example of Brahms' irresistable drive. Not that there are not magical moments in Pollini's and the VPO's playing under Abbado. Among the most bewitching of these is the cello solo at the beginning of the second movement, which sounds as if it is being played anonymously by one of the world's best cellists, and the marvellous piano entry that immediately follows it. Here are passages to make you hold your breath in case you miss the very slightest moment of ecstacy. But often, instead of underscoring Brahams' monumental structure, there is a tendency to over-lyricise it.

The only word I can think of to describe the atmosphere is a sort of lyrical reverie. And the same might be said of the orchestra shown up in Abbado's perfect collaboration. I wonder whose idea the whole conception was, the pianist's or the conductor's? Or did they work it out in perfect agreement

between themselves? The astonishing fact is that it should be so entirely different to his method of thought shown in his extraordinary performance of the Hammerklavier. But, as I wrote just now, there are wonderful moments that cannot be exactly called Brahmsian, at least not in the manner he wrote this concerto. And I must emphasise that there is nothing sentimental in the treatment. It is just that, despite its occasional burst of energy, it is all a wee bit wayward, or even at times, a bit shallow. (J.R.)

TCHAIKOVSKY 4th: quality or value?

TCHAIKOVSKY — Symphony No 4 in F Minor. Cleveland Orchestra conducted by Lorin Maazel. Digital Master Stereo Telarc 10047. (From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122.)

In the May issue of EA, Neville Williams reviewed a new digital recording of the Tchaikovsky fourth, confining himself chiefly with the technical features of this extraordinary disc. He has since asked me to review it from a music critic's angle. So here it is.

First let me fully endorse all the praise Neville has been lavishingly lately on the new method of digital recording. The sound on the Tchaikovsky is amazingly faithful and the tone naturally rich without being artificially enriched. Furthermore, the perfection of the orchestral balance makes effortlessly audible every tiny detail of the score without fuss or unnecessary spotlighting. Recently I reviewed in this column a DGG recording of the same symphony played by Karajan and the Berlin Philharmonic, which I praised in the very highest terms. The sound on this was judged by the highest orthodox engineering, of the finest quality. But I must confess that the digital recording was the better.

Not so however the performance. Maazel and the Cleveland are definitely below their best in this work. Sometimes, but not always, they sound a little placid in the first movement. At times Maazel seems suddenly to realise something is wrong and starts to hurry the tempo in a way that comes as a bit of a shock. It is hurry without passion although some of the climaxes are superbly prepared and delivered.

The second movement is played very correctly — a little too much so, if you know what I mean. It sounds a little starchy. The Scherzo however is a marvel of precision and carefully chosen tempos.

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

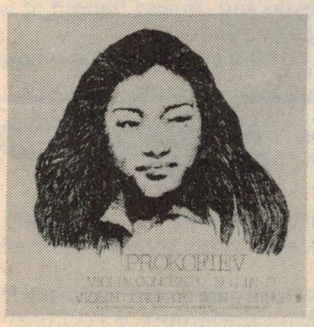
The short pizzicato notes and very short notes in the other orchestral sections are absolutely faultless. And there is a piccolo entrance that will literally make you sit up. It did me. The Finale goes with great gusto.

But now comes the rub, to put it Shakespeareally. The retail price of the digital disc is $19. The DGG disc sells for a few cents more than $9. Despite the undoubted superiority of the digital engineering I fear there may be many who, in view of the excellence of the Karajan performance and engineering, might think "I'd rather do with this and spend the saved $10 on another disc than cough up the $19 asked for the other". With all its marvels the digital disc will have to come down drastically in price for it to appeal to listeners other than those with a consuming interest in technical quality. (J.R.)

A recording to treasure

PROKOFIEF: Violin Concerti No. 1, D major & No. 2, G minor. Kyung-Wha Chung, violin; London Symphony Orchestra, conducted by Andre Previn. World Record Club stereo disc R 06065.

Whilst the G minor concerto is a firm favourite with virtuoso fiddlers, Prokofief's first violin concerto is not nearly as often heard. On three previous occasions I have heard the works coupled on LP: Isaac Stern recorded them in 1964 and supremely well; a little later, Ricci turned to them and Nathan Milstein as well. Of all these, Stern's were the most convincing readings and even they pale by comparison with Kyung-Wha Chung's music making. It is doubtful that she plays the violin any "better" than her illustrious predecessors, but she alone seems never to succumb to virtuoso seductions.



These works are full of very beautiful music, and of the composer's very individual spirit; by some alchemy, this young musician and conductor Previn are enabled to discover all the things that others often miss. The D major concerto (opus 19) was first heard here from Stern (conducted by Goossens, in 1947) and I confess I've never heard anything as good since – but one's memories of "firsts" are always suspect. In any event, this performance is exemplary – from the breath-taking tempo in the Scherzo to the final sounds of loveliness.

In opus 63, a work Oistrakh used to shine in, the soloist is just as good and so is the orchestra, not to be faulted anywhere. My only reservation is that the violin's sound is a shade forward; this, of course, may well be what Mr Previn wanted or, again, may have been intentionally engineered at the soloist's request. This is a recording to treasure! (P.F.)

☆ ☆ ☆

BALAKIREV – Symphony No. 2. Moscow Radio Symphony Orchestra conducted by Gennady Rozhdestvensky.
CIURLIONIS – The Forest. Symphonic Poem. Lithuanian Philharmonic Orchestra conducted by Juozas Domarkas. A Melodia/HMV recording issued in Australia by the World Record Club. WRC R06097.

Balakiref, despite his importance to Russian music, has remained comparatively unknown in Western Europe except for two pieces: a good ballet, Tamar, long since dropped from the repertoire, and a dazzlingly virtuoso piano piece, Islamey, nowadays scarcely heard at all. Yet during the latter half of the last century he was, in Russia, a very influential musician indeed. He was the founder and mentor of the famous Five, a nationalistic school of composers comprising Moussorgsky, Rimsky-Korsakoff, Cui, Borodin and himself. His own output was respectably large. He also encouraged performances of such non-Russian composers as Schumann, Chopin, Liszt and especially Berlioz. He was a brilliant pianist and all-round musician; yet, nowadays, he's as dead as Medtner.

The symphony under review is tuneful and shows no significant development of sonata form. At its best, I can find no more expressive word to praise it than "pleasant". You can hear an occasional snatch of Tamar and passages of Rimsky-Korsakoff, though who influenced whom must remain a matter for conjecture. Its outstanding movement is the Scherzo in dance rhythm, marked by the composer alla Cossacka. The conductor takes it steadily, never letting it tempt him to run away. It is deliciously accented. There is a movement marked Romanza, only too reminiscent of the Fountain Love Scene in Boris. This, by the way, is not an example of Moussorksky at his best but Rozhdestvensky does his best to disguise its mediocrity.

I'm afraid that much of his work yields no better than cosmetic results. The finale is a Polonaise, which is cleanly and spiritedly played, as is the rest of the symphony. But the finale has one curiosity – a, to me, senseless intrusion of music from the Romanza movement. The sound is good/average.

The Lithuanian composer's tone poem "In The Forest" is a straight-out bit of 19th century run of the mill romanticism, with little to recommend it but its novelty. It is not as well recorded as the Balakirev and is played by a different orchestra and conductor. (J.R.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

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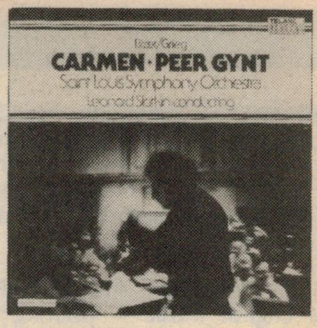
Impressive dynamic range



CARMEN. PEER GYNT. Bizet/Grieg. Saint Louis Symphony Orchestra conducted by Leornard Slatkin. Digital master stereo. Telarc 10048. [From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612].

It took only the first few grooves to indicate to me that this disc was going to be a pleasure to review. It had that transparent, effortless quality that suggested good mic placing, good acoustics, and a recording system notably free from intermodulation. There is an apology in the notes for a slight rumble from the auditorium air conditioning (temperature outside was 100°+ F) but my guess is that few will notice it. Certainly, the orchestra and conductor performed the better for it.

There are eight excerpts from Carmen. Suite 1: Prelude to Act 1 – Argonaise – Intermezzo – Sequidilla – Les Dragons – D'Alcala – Les Toreadors. Suite 2: La Garde Montane – Danse Boheme. From Peer Gynt: Ingrid's Lament – Arabian Dance – Morning Mood – Ase's Death – Anitra's Dance – In The Hall Of The Mountain King.

Despite my earlier remarks about technical quality, this may not be an ideal demonstration disc, because instant spectacle is not what it's all about. But in the quietness and relaxation of a home listening room, the orchestral texture and colour and the impressive dynamics can be appreciated. In the softest passages, the instruments murmur in the stillness; in a couple of tracks, such as The Toreadors and The Hall Of The Mountain King, the whole room pulsates with the drums – without a suggestion of overload and muddiness. Add this to the familiar music and you have the potential for a very popular album. (W.N.W.)

ARNOLD — Symphony No. 2. English Dances. Bournemouth Symphony Orchestra conducted by Sir Charles Groves. World Record Club compatible stereo/quadrophonic disc WRC OR 04972.

Malcolm Arnold is the jack-of-all-trades of English music — pouring out symphonies, popular songs and fugues as well as film music. And all of it is of the same high standard. But that his fecundity has its serious side is shown in this symphony. If you're an Arnold fan, don't let this put you off. It is consistently tuneful because Arnold believes, I quote him: "Music is a social act of communication among people, a gesture of friendship, the strongest there is".

He never writes like the avant garde who, with few exceptions, are people of little talent with an ear permanently cocked for "what's in". If many of these composer's of once-played operas to sparse audiences are soon forgotten a few may linger on until music rescues itself from its present degradation. To listen to their output can be either a puzzle or a bore; to effects created mainly to startle.

Not so Arnold, who produces no mathematical constructions of sound but music within the understanding and enjoyment of the real music lover; not music for the small fashionable coteries who encourage fakes of all kinds. Yet, when Arnold deems it necessary, he can use all the avant garde tricks; but, being a real musician, can make them both comprehensible and enjoyable. This is not to say he is a great composer, although he never fails to please the ears of a normal audience.

An analysis of this symphony will reveal many complexities, even some serialism. But, under his pen, it always sounds right — and musical. Moreover, if you look hard enough, you will find plenty of fun, too. And the scoring, especially that of the scherzo should be studied by every student of orchestration. It is admirably played by the Bournemouth Symphony Orchestra under Sir Charles Grove.

The English Dances sound a bit like folk music but they're Arnold's own tunes and provide someone in search of relaxation with grand fun. There are eight in all in a variety of kinds, tempos and rhythms. (J.R.)

★ ★ ★

VIOTTI: Violin Concertos No. 16 in E minor and No. 22 in A minor. Yehudi Menuhin, solo violinist and conductor, with the Menuhin Festival Orchestra. World Record Club stereo disc R 06077.

At the turn of the century, when my father studied the violin, the numerous works by Giovanni Battista Viotti (1755-1824) were still considered part of the essential concert repertoire. In our century, critical opinion relegated them to the limbo of showy virtuoso pieces and whole generations of concert-goers have never heard as much as one of his major works. It has taken a fiddler of Menuhin's status to dare unearth Viotti's music again and, lo and behold, it is exceedingly fine music!

Viotti, in his day, had been the product

Direct cuts and ultimate tragedy — almost!

AGAIN. Rob McConnell & The Boss Brass. Stereo, two-record set, Umbrella UMB-GEN 1-12. [From MR Acoustics, PO Box 165, Annerley, Qld. Phone (07) 48 7598].

In discussing direct-cut discs, writers sometimes ponder the dismay of all concerned when something occurs to render the whole effort futile. This is one case where it really did happen.

Following the success of the Boss Brass' first direct-cut album of jazz, Canadian "Umbrella" decided on a sequel — a large scale operation requiring lengthy planning both at an engineering level and by the 22-man Boss Brass. Came the big day and all seemed to go well. But then disaster struck.

For some unexplained reason, all four of the disc masters were ruined in the processing and the whole project was shelved. But, eight months later, the producers listened again to the standby master tapes and decided that the music had to be saved. So, with great care, the tapes were mastered on to special Pyral blanks at half cutting speed, processed and pressed in special quality vinyl. Said the engineers: "We got to within a hair's breadth of the original direct-cut sound."

And, yes, the sound is good by analog standards and so is the music — a mix of bepop, blues, jazz and sentimental that breaks out into virtuoso fun. The tracks: Confirmation — Everytime We Say Goodbye — The 4,679,385th Blues — A Time For Love — Take The "A" Train — My Ship — Tickletoe — I Hear A Rhapsody — Pellet Suite (No! Not Sir Henry; Last Summer; The Back Bacon Blues; BB Gun).

If you're interested in virtuoso brass — trumpets, trombones, French horns, saxophones, plus rhythm and a touch of piano and guitar, you'll find plenty to listen to, and plenty to read about the players and their music in this elaborate double-fold-plus jacket, priced at $24. (W.N.W.)

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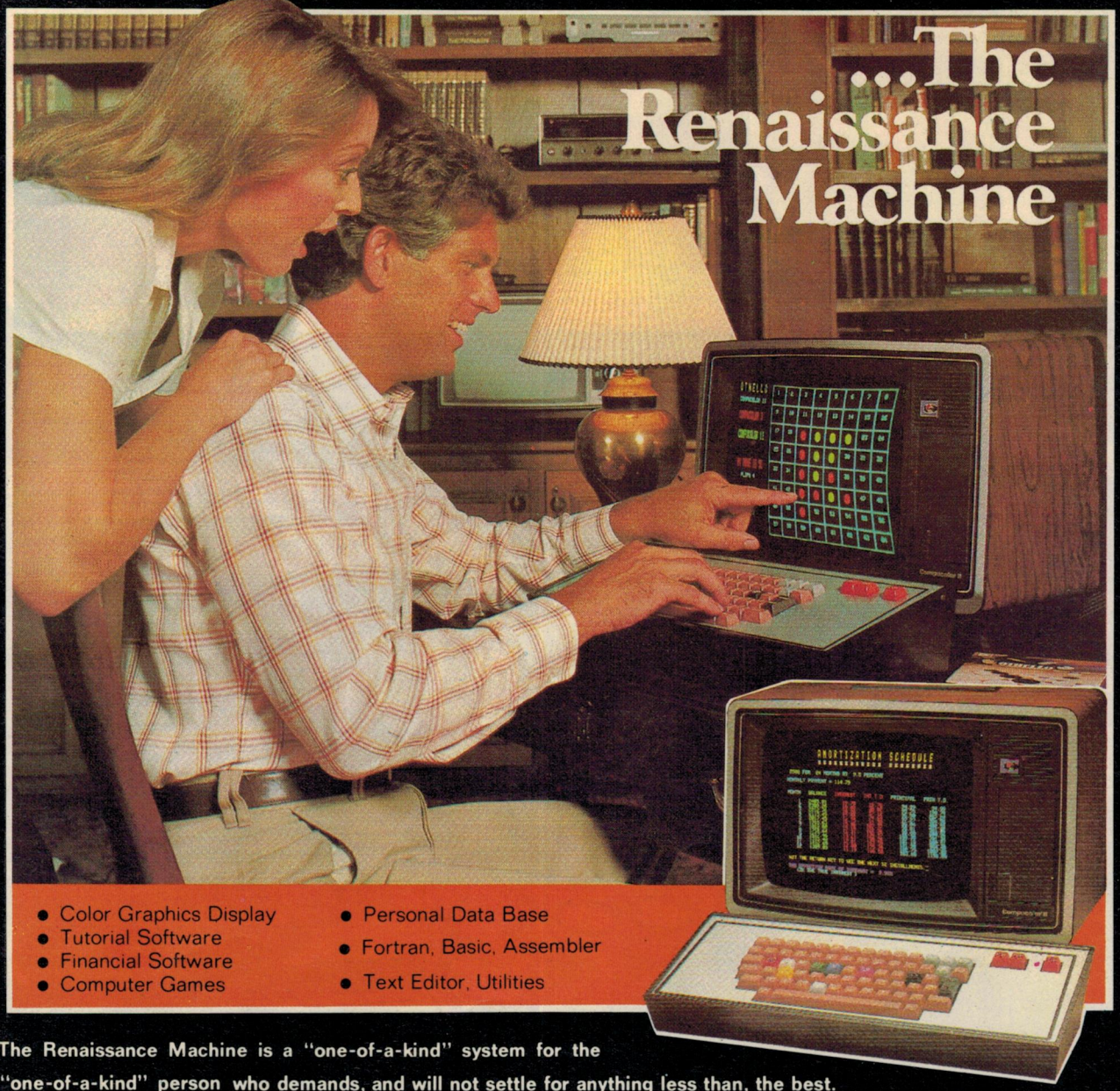

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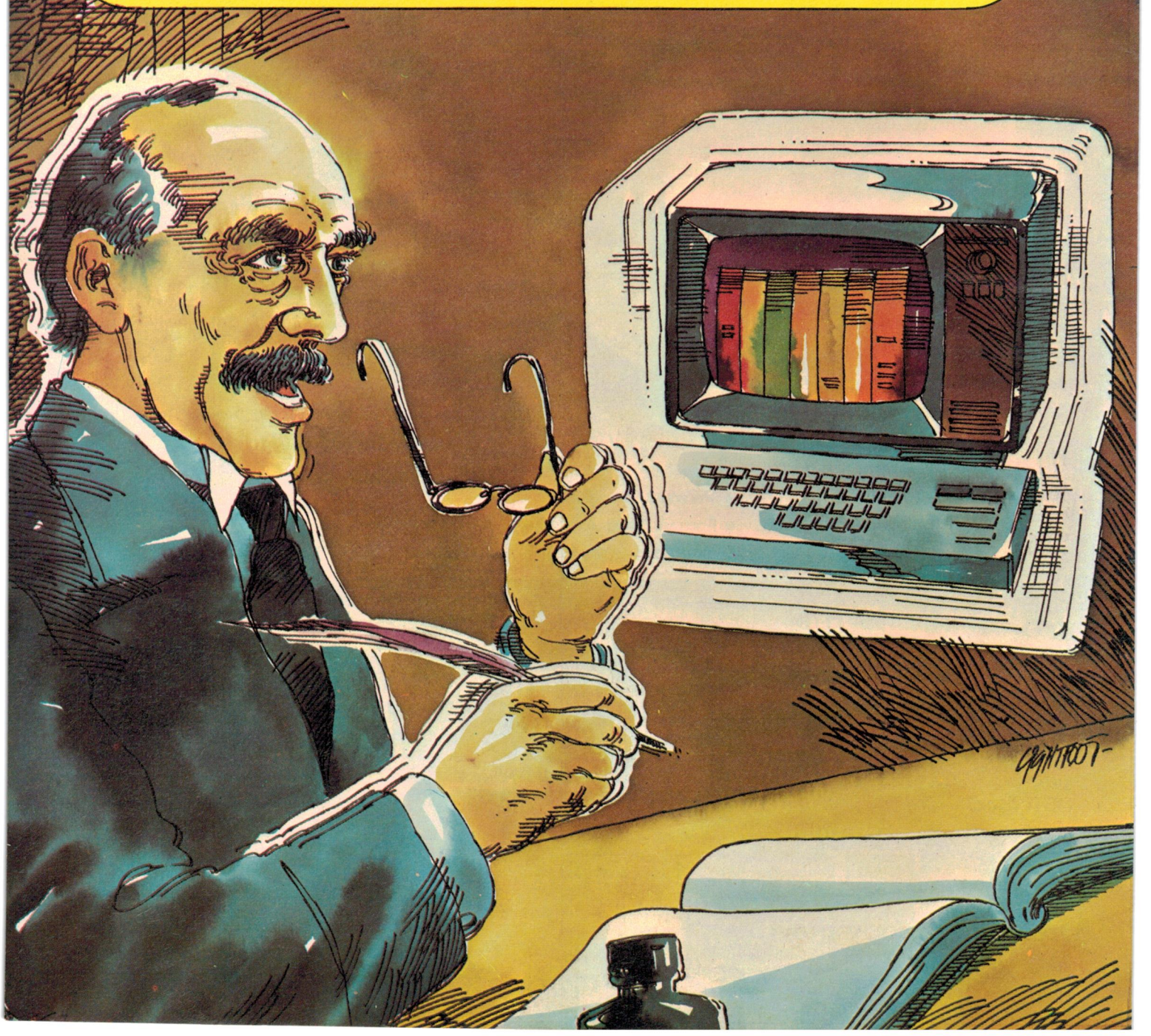

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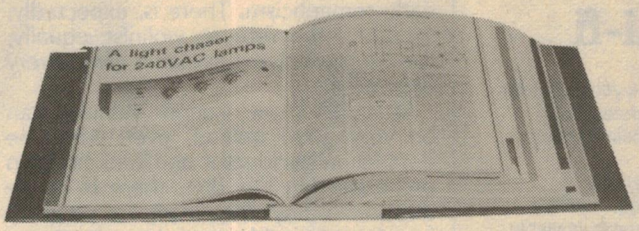
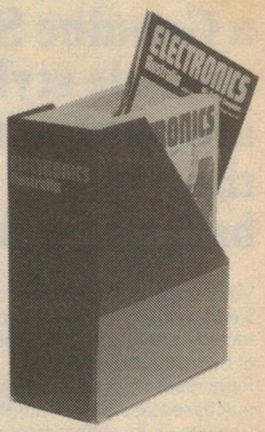
What's new in magazine holders

The binders with metal retaining rods can provide security and protection for older issues, while the new style holders (right) can provide quick access to more recent issues.





Two varieties of folders are now available for your copies of "Electronics Australia". The previously available binders with metal retaining rods for 12 issues can still be obtained but, in addition, there is a new magazine holder which provides protection and accessibility for loose issues.

The new holder is finished in the same attractive brown vinyl and gold lettering as the binders, and provides space for a full year's issues. The holders are designed to stand upright and hold the issues loosely, without the security provided by the retaining rods of the binders and without the need for unfastening the rods to remove an issue.

The magazine holders are supplied flat, but can be folded up in a few seconds to form a strong box with a cut-away side. A clear plastic envelope on one side of the holder allows the user to insert labels with the relevant dates etc. It might also be a good idea to slip an index into the envelope, so that articles of interest can be quickly located.

Another possibility is to use the binders with the retaining rods for holding past issues in a secure way and use the magazine holders for the more recent issues, or the issues which are most frequently consulted. Readers can thus have the best of both worlds, with security and protection for older issues in the binders and the convenience and quick access of the new magazine holders.

The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: $5.10 binders, $4.50 holders.

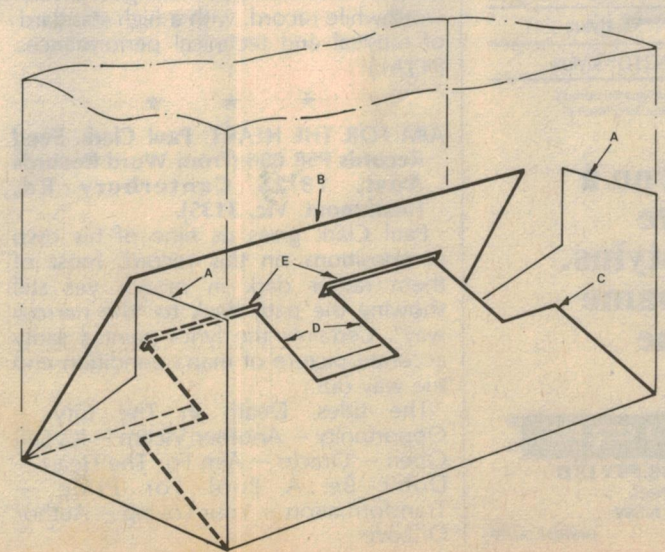
Mail orders should be sent to Electronics Australia, PO Box 163, Beaconsfield, NSW 2014.

Prices including postage are:

Binders: $6.20 NSW; $7.90 other states; or six for $32 NSW, $34 other states, A$36.60 NZ.

Holders: $5.40 NSW; $5.50 other states; or six for $28.30 NSW, $30.40 other states, A$32NZ.

How to fold the magazine holder



Push flaps "A" up into box followed by flap "B" then flap "C". Insert tongues "D", into slots "E", and then push "B" and "C" down to form bottom of box.

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of an illustrious chain of violinist-teachers which included Corelli, Tartini and Pugnani; we need not, therefore, be surprised at the way he wrote for his instrument. Less expected is the purely musical content, in the case of the E minor concerto enriched by additional instrumentation from none less than Mozart! Musically, there really is a great deal to both admire and enjoy — a blending of the classical with traces of baroque tradition and many a foretaste of early romanticism. There is, expectedly, scope for the virtuoso violinist; equally, the interpretative musician is given every opportunity.

As we all know, Yehudi Menuhin can be very good indeed, even when he doubles as conductor and runs his own orchestra. On this disc, there is no indication of any distraction, no weakening of musicianship or of virtuosity. Some may argue that Viotti concerti (there are 29 of them all told) should remain forgotten: for my part, I'll be perfectly happy to hear another half-dozen or so if they are in the hands of Menuhin. (P.F.)

WAY OUT IN FRONT. Ray Thornley playing the Yamaha D85 Electone Organ. Stereo, Audio Arts Enterprises IMA-8020. [From Soundbank Pty Ltd, PO Box 248, Gladesville, NSW 2111. Phone (02) 89 2812.]

Ray Thornley has already made a name for himself as an organist with more than the usual aptitude for orchestral arrangement and sound. Equipped with the Yamaha D85 and with the multi-recording facilities under the hand of engineer/producer Malcolm Abel, he has been able to demonstrate his skills to advantage in this new album.

This is a one-man organ recording but the total sound is essentially that of an orchestra as he (they?) play: Annie's Song — Just The Way You Are — Solitaire — Six Ribbons — Plaisir d'Amour — You Don't Bring Me Flowers Any More — She — The Man With The Child In His Eyes — Song For Anna — Sheep May Safely Graze — Georgia On My Mind — Wave.

With these titles and with very clean sound, Ray Thornley's new album should find ready acceptance from listeners

DEVOTIONAL ALBUMS

FARRELL & FARRELL. A Portrait Of Us All. NEWPAX NP33076. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

The young couple, Bob and Jayne Farrell, featured on this record, give us 11 excellent Gospel songs, mostly of their own writing.

The musical style is mainly rock, with some ballad style singing. The tracks are: I Couldn't Live Without You — Fallen — Put More Love In Me — Can't Ask Anything More — Boundless Love — No Need — Find It In The Word — Jailhouse Rock — All You Need — Scars — A Place In His Heart For You.

The lyrics, printed on the inner sleeve, are true to the Gospel, making for a very worthwhile record, with a high standard of musical and technical performance. (N.J.M.)

★ ★ ★

AIM FOR THE HEART. Paul Clark. Seed Records PSB 008 (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic, 3135).

Paul Clark gives us nine of his own compositions on this record, most of them rather dark in mood, yet still showing the path back to "the narrow way". Certainly the lyrics paint a sadly accurate picture of man's condition and the way out.

The titles, Death In The City — Opportunity — Another Victim — It's Still Open — Oracle — Aim For The Heart — Don't Be A Fool For Pride — Transformation — Your Loving — Author Of Love.

The music is mainly rock in style with an excellent backing group; the credits even list someone who supplied Ping-pong and Perrier. (N.J.M.)

★ ★ ★

THE SWEET COMFORT BAND. Hold On Tight. Light Records LS-5762 (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135)

Sweet Comfort Band is a group of California based Gospel musicians with a strong rocking style and an equally strong lyric line with a true Gospel foundation.

The 11 tracks are: Hold On Tight — Take It, Save It — Falling Star — You're the One — Angel — Chasin' The Wind — Don't Tell Me — Undecided — Carry Me — More Than You Need — Find Your Way.

The inner sleeve carries the full lyrics together with a listing of all those involved in the production of the record.

"The message in the lyrics is for those who have known the truth but have wandered and to those who are still seeking it". That quote from the sleeve notes is borne out by the music. (N.J.M.)

other than just organ enthusiasts because, for all practical purposes, it is an eminently listenable orchestral performance. (W.N.W.)

★ ★ ★

TRANQUILITY, Mary O'Hara, 20 Songs Of Life. Chrysalis L37339. Festival release.

This album is a treat for ballad lovers, with 20 favourites, old and new, sung with grace and feeling by Mary O'Hara. The record appears to have been recorded at a low level, probably to accommodate all the tracks, so you will have to turn up the wick a little.

Some of the tracks are: The Floral Dance – Streets Of London – Barbara Allan – Shepherds Song – Scarborough Fair – Bright Eyes – Leaving On A Jet Plane – It's Me O Lord – All Through The Night – Where Have All The Flowers Gone – Killing Me Softly With His Eyes.

Judging by the photo on the cover the singer's voice is matched by her beauty! (N.J.M.)

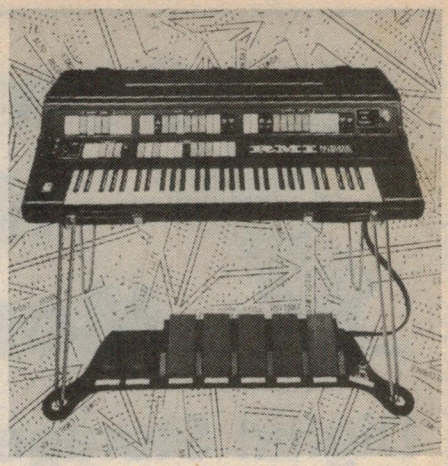
★ ★ ★

CATCHING THE SUN. Spyro Gyra. MCA Records 5108. (Astor Records).

Spyro Gyra is an instrumental group from New York, and consists of Beckenstein on saxophones; Kurzdorfer on bass; El Konoikoff on drums; Tom Schuman on keyboards; Chet Catallo on guitars and Gerardo Velez on percussion.

RMI KEYBOARD COMPUTER KC-11

"Son of Allen"



RMI KEYBOARD COMPUTER, Model KC-11. Demonstration Record. [From Allen Organs Aust, 32 Woodhouse Rd, Doncaster East, Vic 3109. Phone (03) 842 3465].

While other factors are involved in a professional music situation, the RMI Keyboard computer/synthesiser certainly impresses in terms of the sounds which it can produce.

As illustrated on the jacket, it looks like a portable organ on a folding stand, with a five-manual fully polyphonic keyboard and a double row of rocker tone switches. In place of the normal expression pedal is a row of five such on a baseboard, plus three foot switches.

The rocker tabs provide a basic selection of imitative sounds, which can be further modified on a phrase by phrase basis by the foot controls – volume, attack, decay, tremolo, etc. More than that, voice can be used two at a time and either alternated or played duet-fashion.

Like Allen computer organs, this "son of Allen" has a programming slot into which can be plugged a whole array of cards, programmed to produce sounds not covered by the rockers. All this is in "real time", the sounds being available instantly for accompaniment or group use.

The 20 or more tracks on the album contain a wide selection of sounds from steel drums, through an array of musical instruments to a most impressive classical pipe organ sound. But one gathers that this would be but the beginning of what the RMI Keyboard Computer is capable of, given the potential number of combinations of rockers, cards and playing techniques.

All I can say is that, if you are interested in a very versatile, and a very musical five octave synthesiser, you should make a point of hearing this demonstration record. (W.N.W.)

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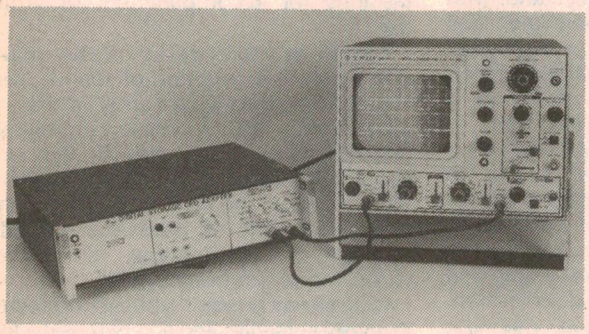

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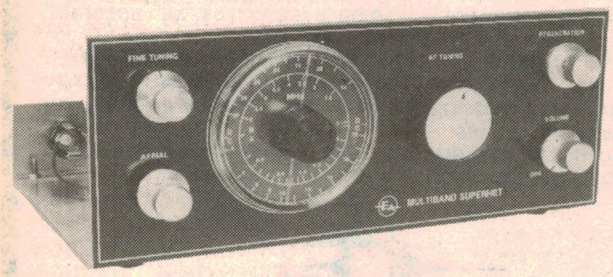

There is more to life than just the AM broadcast bands, even if some stations do have a bandwidth of 15kHz. Developed as a follow-up to our highly successful All-Wave Three published last April, this sensitive little superhet receiver can pull in a surprising number of stations with a good antenna and a modicum of skill on the part of the user. It covers the range up to 30MHz.

* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

electric blue

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The group has its roots in jazz but combines influences of rhythm, blues and rock. This third album from Spro Gyra should be particularly entertaining for jazz followers. You can expect to hear much more from him.

The nine tracks on this album are: Catching The Sun — Cockatoo — Autumn Of Our Love — Laser Material — Percolator — Philly — Lovin' You — Here Again — Safari. (D.H.)

★ ★ ★

IN THE QUIET HOURS, 101 Strings. Alshire S5026. Astor Release.

The 101 Strings give an average performance of eight old-time favourite melodies on this record. It is marred somewhat by a rather "edgy" sound to the strings and limited dynamic range, making it a record for quiet background listening rather than for more direct listening, as one would with a more star studded performance.

The titles are: All Through The Night — Berceuse — Greensleeves — Romance — Traumerie — Serenade — Romance (Tchaikovsky) On Wings Of Song. (N.J.M.)

★ ★ ★

LADY T. Teena Marie. Motown G7992. Astor Records.

This album by Teena Marie is a mixture of up-tempo disco tracks and ballads. Each of the nine tracks have refreshing vocals and musical arrangements. Eight of the tracks were written by Teena Marie and display her songwriting talent. Her voice is very pleasant to listen to and in many cases soars above the music. All told, an excellent album from a very talented artiste.

The nine tracks on the album are: Behind The Groove — Now That I Have You — Lonely Desire — Aladdin's Lamp — You're All The Boogie I Need — Can It Be Love — Young Girl In Love — Why Did I Fall In Love With You — Too Many Colours. (D.H.)

★ ★ ★

AND HOW. Blonde On Blonde. SPLP 1578 Astor Records.

Blonde On Blonde is Nina Carter and Frankie Ward, two blonde bombshells who really sing up a storm on their debut album . . . "And How". The girls get a helping hand from an impressive array of studio musicians and the album's arrangements and production are tight and crisp. Spicy re-workings of Led Zepplin's classic "Whole Lotta Love" and the Box Tops "The Letter" are two of the high-points on this excellent debut album.

Tracks on this album are: Whole Lotta Love — Shut Down — Love In The Afternoon — Who's On The Line — Hold On, I'm Coming — Past, Present And Future — The Letter — Woman Is Free. (D.H.)

EVITA. Premiere Australian Cast Recording. Music, Andrew Lloyd Webber; Lyrics, Tim Rice. Stereo, MCA (Astor) MCAEVI.

Astor are obviously very proud of this release, and well they may be. Recorded by AAV in the studios of ABC station 5AN Adelaide, it features Jennifer Murphy as Evita, Peter Carroll as Peron, John O'May as Che, Tony Alvarez, as Magaldi, and Laura Mitchell as Peron's mistress.

The basic story — the rise and fall of the late Eva Peron in Argentina — is now so well known as to be taken for granted. But the 15 tracks on this album will serve as a generous reminder: Requiem For Evita — Oh What A Circus — On This Night Of A Thousand Stars — Buenos Aires — Goodnight And Thank You — I'd Be Surprisingly Good For You — Another Suitcase In Another Hall — A New Argentina — Don't Cry For Me Argentina — High, Flying Adored — Rainbow High — And The Money Keeps Rolling In — Waltz For Eva And Che — She Is A Diamond — Lament.

The entire performance is vital, with excellent diction, and the sound quality very clean. Add to this a handsome double-fold album, with colour portraits of the stars and company in costume, plus generous credits and notes, and you have an excellent memento of one of the big musicals of the decade.

If you enjoyed the show, the album is a must. (W.N.W.)

THE CLASSIC SOUNDS OF LOVE. The 101 Strings Alshire S5378. Astor release.

Whoever had the job of choosing the title for this album must have been daydreaming, because I cannot with any reasonable stretch of the imagination, associate Ravel's Bolero or the 1812 Overture of Tchaikovsky with anything even remotely romantic in theme.

This aside, the tracks are pleasant enough renditions of these two concert favourites.

The cover photo of a couple in an embrace on the sea-shore is more ridiculous even than the title! (N.J.M.)

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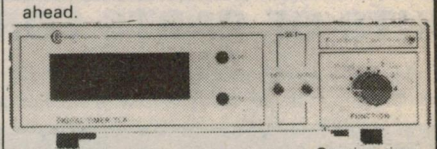
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Books & Literature

Microcomputer Systems

MICROCOMPUTER SYSTEMS — an applications approach, by John P. Grillo and J. D. Robertson. Published by Wm. C. Brown Company Publishers, Dubuque, Iowa, USA, 1979. Soft covers, 154mm x 228mm, 318 pages. Illustrated with photographs, flowcharts and diagrams.

As stated in the preface the objective of this book is to present the essential hardware and software features that make up a microcomputer system. The book is intended for use as a text book for introductory microcomputer courses, and begins simply and gradually builds the reader's understanding of the hardware and software of a typical microcomputer system.

The book can be considered in three parts. Chapters one and two are introductory material, and present the microcomputer in relation to other hardware, such as calculators, and in the perspective of the typical business user. Chapters three to seven describe the components of a microcomputer system in detail, fully explaining the functions of each section and the integration of these section in an application. Chapters eight to 11 present a wide range of computer programs at various levels of complexity, from simple games to advanced file management and sorting techniques.

All of the programs in the book use Radio Shack's Level II Basic, and are designed to run on a TRS-80 with 16K of RAM and a single minifloppy disk drive.

The book covers a lot of ground, from introductory material to sorting algorithms and file management software. It tries to provide something for everyone, and in the main it succeeds. It would be a valuable reference source for students and professionals and for the businessman who wants to know more about computers.

The emphasis throughout is on a system approach, treating hardware and software as they interact to form a functioning system. Chapters on software fully explain the differences between various versions of Basic, and offer suggestions as to what to look for in buying a Basic interpreter. Chapter eight, on applications software explains the problems of choosing a software package, and provides useful guidelines to anyone involved in the purchase of software.

Each chapter concludes with a set of exercises which reinforce the reader's grasp of the material covered, and a comprehensive reading list is also provided for each of the topics covered by the book. Chapter II, concerned with systems programming, traces the implementation of three common uses for a small computer system, explaining at each step why a certain course of action is chosen and the advantages it offers.

"Microcomputer Systems" goes a long way in a short space. Anyone from the beginner thinking of buying a system to the data processing professional will find something of interest in it. This also means of course that there will be sections of the book which will be of no interest at all to a particular reader. Disk management techniques are of no use unless you use a disk-based system, and the introductory chapters will be skipped over by the experienced user.

Nevertheless whatever your degree of expertise, have a look at "Microcomputer Systems". It has a lot to offer.

Our review copy came direct from the publishers, but the book should be available in technical book-shops and computer stores by the time you read this. (P. V.).

Microprocessor Primer

A MICROPROCESSOR PRIMER by E. A. Parr. Published by Bernard Babani 1980. Stiff paper covers, 181 x 109mm x 90pp. Price in Australia $5.25.

Intended for people interested in microprocessors, but assuming almost no prior knowledge, this book looks at very basic concepts of computers and gradually takes the reader to the stage where at least a basic familiarity with microprocessors is gained.

The opening chapter introduces the reader to basic computer architecture, building upon the idea step by step in a logical fashion. The first step is to draw on a real life example and break this down into a number of well defined steps such that they can be performed by a computer. After the problem has been defined, the author takes the reader by the hand in the development of a computer system, starting with the definition of the instruction set.

The computer is developed and then programs are written for it, thus showing the reader how problems can be solved in a systematic and ordered way.

Other subjects that are talked about include assembly language, computer I/O (input and output) and then concluded by comparing the computer developed in the text to the now well known Z80 processor.

All in all I think that this book has a lot to offer the reader who knows little or nothing about computers. It is good value for money at the quoted price of $5.25.

Our copy came from the Technical Book and Magazine Company, 289-299 Swanston Street, Melbourne 3000. (G.C.)

General Ledger

GENERAL LEDGER (Standard Software Library Vol 1) by Louis D. Grey. Published by Creative Computing Consultants Inc 1 Quarry Lane, Norwalk, Connecticut, USA. Soft covers, 213mm x 276mm, 98 pages. Illustrated with flow-charts and diagrams. Price $25.

Perhaps the main impediment to the increased use of microcomputers in small businesses has been the lack of the necessary software. Many microcomputer systems are available with the capacity to handle the requirements of small business, but until recently business application programs have either been expensive, ill-suited to the needs of a particular business or designed to run on a particular system, with no latitude for change.

This book is an attempt to fill that gap, and I feel that it succeeds very well. General Ledger is the first volume of "The Standard Software Library", and is followed by two other volumes, Accounts Receivable and Payroll Accounting.

The book opens with a guide to the General Ledger program, a brief introduction to the benefits of computerised accounting, and a section on how to use the programs, which begins with the reassuring words "Congratulations. You have just taken a major step towards achieving an automated General Ledger accounting system".

In two pages the book then gives a list of the equipment needed to use the programs and a brief introduction to Basic, supported by a comprehensive bibliography in Appendix B. The author suggests that a system with at least 16K of RAM is required, together with a floppy disk system and a printer. A list of major microcomputer manufacturers is given in Appendix A.

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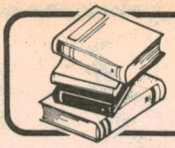


Books & Literature

The next section of the book gives an overview of the system, explaining how a chart of accounts is created as the first step in using the programs. A flow-chart is provided which details the order in which the programs are used to create an integrated accounting structure. Appendix D provides a sample of the forms used for recording transactions in preparation for transfer to the computerised system.

The main section of the book is taken up with annotated listings of the ten programs which make up the General Ledger system. The individual programs are short, written using statements which are common to most versions of Basic, and obviously designed with the "human interface" – or the presentation of the program from the operator's point of view – in mind.

Notes on the conversion of the programs to other versions of Basic are also provided. There are two aspects of the programs which might need adaptation to a particular system. The first of these are the instructions which deal with accessing files from disks, which are usually specific to a given version of Basic. The other type of instruction which may be lacking in some versions of Basic is the PRINT USING statement, which may need to be replaced with an appropriate PRINT statement.

Our review copy came from Paris Radio Electronics, 7a Burton St, Darlinghurst, NSW, 2010. We understand that copies are also available from J. H. McGrath, 208 Little Lonsdale St, Melbourne, 3000.

Music Projects

ELECTRONIC MUSIC PROJECTS by R. A. Penfold. Published 1980 by Bernard Babini Lt, London. Stiff paper covers, 106 pages 180mm x 110mm, circuits only. Price in Australia $5.25.

By and large, the circuits in this book are of the simpler variety, intended for the amateur enthusiast who has a special interest in amplified musical instruments.

Chapter one details seven effects mainly applicable to guitars: fuzz, waa-waa, sustain, etc. Chapter two suggests gadgets with a wider application, such as tremolo, reverb, phaser and modulator.

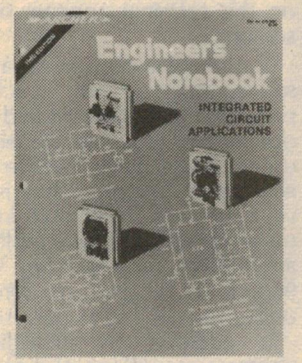
Five sound sources are detailed in chapter three including noise generators, a tone generator, a vibrato generator and a small stylus organ. Accessories feature in the last section: tuning aid, guitar practice amplifier, metronome, auto fader, a simple mixer and a sound to light unit.

Circuits are presented and explained but, as no detailed constructional help is

given, the book would be of use only to those able to work without it. If it's what you're looking for, you can obtain a copy from The Technical Book and Magazine Company Pty Ltd, 289 Swanston St, Melbourne, 3000. (W.N.W.).

Engineer's Notebook

ENGINEER'S NOTEBOOK, INTEGRATED CIRCUIT APPLICATIONS, 1980 EDITION, by Forrest M. Mims, III. Published by Radio Shack Technical Publications, Fort Worth Texas, USA 76102. Soft covers, 280 x 215 x 128pp. Tandy Cat. No 276-5001. Price $2.49.



The author of this notebook is well known for his contributing articles in "Popular Electronics". Written in a note book style, the text is concise and easy to understand. As it stands the book is an excellent reference source, with many diagrams and example circuits. For some readers, this book will contain almost all the reference material likely to be needed.

Starting with a brief overview of resistor, capacitor and semiconductor basics the book moves on to digital integrated circuits. CMOS types are introduced first and the common NAND gate, NOR gate, buffers, decoders, flipflops, counters, PLLs, RAMS, generators etc, are given a thorough treatment. TTL, and LS TTL integrated circuits are in the next chapter and a similar treatment is given to these.

The last chapter deals with linear integrated circuits including voltage regulators, operational amplifiers, comparators, timers and dot bar displays. Example circuits are given such as bandpass filters, infrared transmitter/receivers and function generators. Design data is given for the various ICs and with this information it is possible to design regulated power supplies, filters and various amplifier circuits.

Overall, this handbook is very good value, providing handy information for the beginner and experienced hobbyist as well. The book is available from all Tandy stores. (J. C.)

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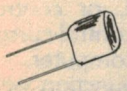

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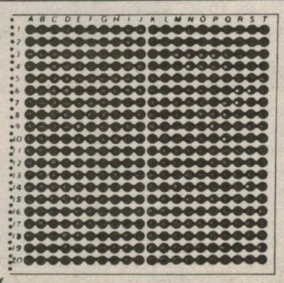

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The EME-30C is a stand-alone alphanumeric video data terminal which features teletype-compatible operation combined with editing and block transmission facilities. Its clean, uncluttered lines, simplicity of operation and a wealth of features make it ideal for use in data entry, on-line enquiries, program development and research systems — anywhere in fact where a low-cost video terminal is required.

The terminal is enclosed in a tough ABS plastic case with a steel base-plate, and measures 440mm wide × 280mm deep × 110mm high at the rear. The keyboard and the case are sloped downwards towards the front, presenting a comfortable typing position. The keyboard is a pleasure to use, with light, precisely acting keys and good tactile feedback.

The keyboard provides 69 capacitive key switches, with N key rollover – meaning that a second, third, or "nth" key can be pressed before the first is released, without confusing the order of entry of the key codes. This allows very fast touch typing. The full 128-character ASCII set is provided (upper and lower case alphabet, numbers, control codes, and punctuation).

Twenty-four lines of 80 characters each are generated by the terminal. Characters are formed in a 6 × 10 dot matrix, with 5 × 9 dots used for the actual character display. This allows lower case characters to be displayed with descenders for improved legibility. The flashing underscore cursor and the underline feature also take advantage of this format. Any character can be displayed with an underline, which can be inserted in the current cursor position either by a keystroke or by using a control character.

Setting up the EME-30C is simplicity itself. The interconnection cable provided plugs into the video outlet at the rear of the terminal and attaches to the inputs of the video monitor. Switching on the power (at the mains point – there is no power switch on the terminal) results in the cursor appearing on the screen. The terminal is now in the full duplex ON-LINE mode, but pressing the LOC key selects the Local mode, and data typed on the terminal appears on the video screen.

Communication is in an asynchronous serial format, with each character preceded by a start bit and followed by one or two stop bits depending on the user's choice. Parity can be set to either even, odd, or none. Data is transmitted via a standard EIA RS232C interface, with transmission rates selectable from seven alternatives ranging from 110 baud to 9600 baud. There is no 20mA interface, unlike previous terminals from EME.

In addition to providing all the necessary functions of a teleprinter terminal the EME-30C includes editing facilities – erase screen, erase to end of line, erase to end of field, and character overwrite – so that data may be composed off line using the terminal in the LOCAL mode, and transmitted to the host computer when the line is established.

Full cursor controls are also provided. The cursor may be moved on the screen by the cursor control keys near the space-bar of the terminal, or control characters may be used to control cursor positioning from the host computer.

The ESC key used in conjunction with alphabetic keys enables the cursor to be moved either left, right, up, or down, and in addition the cursor can be positioned in terms of an X, Y address.

The EME-30C uses a microprocessor for all control functions, allowing program and hence operating characteristics to be changed or added to as required. Operating characteristics are fully under the control of the user without the need for installing wire links or even opening up the case. Data transmission rate, number of parity bits and stop bits, and full and half duplex operation can all be selected either from the keyboard or by the host computer.

The terminal can be used in four modes. In the CAPS LOCK (or TTY mode) all the alphabetic keys generate upper case ASCII codes while the numeric keys remain unchanged. The CAPS LOCK key remains down when pressed, and is released by operating the adjacent shift key. This mode allows convenient use of the terminal with a computer set up for

upper case transmission only, and allows the EME-30C to be used as a direct replacement for a teletypewriter terminal, providing silent, high-speed communication with a host computer.

If the LOC key is pressed the terminal will be set up for operation in the LOCAL mode. Data entered from the keyboard will be displayed on the monitor, and transmission to the computer will be made only in response to a Control/S or Control/Q. The local mode is exited by the operation of the LINE key, or after transmission of a block of data in response to Control/S.

In the LINE mode the terminal is in continuous communication with the computer it is connected to. The user can choose either full or half duplex operation from the keyboard. If the host computer is programmed to echo received characters full duplex operation is normally selected. In the half duplex mode characters received from the computer and from the keyboard will be displayed and acted upon, whereas in the full duplex mode only data from the computer is recognised. LINE mode is selected by operation of the LINE key, with full or half duplex operation selected by typing PROG/F or PROG/H.

The procedure for setting the baud rate for data transmission is a little unusual. Two baud rate ranges are available, an upper range of 110, 1200, 2400, and 9600 baud, and a lower range of 300, 600, and 2400 baud. Typing PROG and U (PROG/U) selects the upper range, while PROG/L selects the lower range. A four position rotary switch at the rear of the terminal then selects which baud rate of the selected range will be used.

A feature of the EME-30C is the "transparent" mode of operation which permits control characters to be displayed but not acted upon. In the transparent mode for example, pressing Return will not cause a carriage return, but will display a CR symbol from the character generator incorporated in the terminal. The control symbols displayed are designed for maximum ease of recognition and understanding, and during program development the ability to display control codes can be very useful.

In spite of the number of options available to the user the terminal is quite easy to use. The manual supplied gives full details of the procedure for selecting any of the optional characteristics, by using the Control, Prog, and Escape keys in conjunction with alphanumeric keys, or by operation of a single key, in the case of the cursor controls or operation mode selection.

At switch-on default values are set for all operating characteristics – the terminal comes on in the on-line, full duplex mode, with the upper range of baud rates available by means of the rear panel switch.

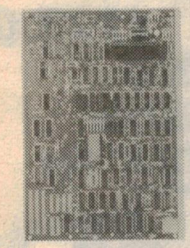
All EME-30 series terminals require connection to a video monitor. A connector at the rear of the terminal provides a composite video signal output of 1V peak-to-peak into 75 ohms, suitable for driving standard monochrome video monitors directly.

With our terminal we used the EME 315 video monitor, a 30cm (diagonal) monitor which provides a clear, well defined display. The dot matrix characters generated by the terminal are displayed on the monitor with a height of 5mm and a width of 2.7mm, and are easily readable. The monitor is basically a standard portable television receiver with the tuner and sound circuits removed. The display is steady and flicker free, and brightness and contrast can be adjusted over a wide range to suit any operating environment.

The EME-30C terminal can be supplied with operating characteristics and character fonts other than those of the standard unit. Because it uses a microprocessor for all control functions extensions and modifications of the operating characteristics can be made easily by changing the operating program. Terminals can be tailored to the user's existing system or intended application. Baud rate ranges, Control functions, Prog functions, or default values for any of the operating parameters can be customised, for example.

The EME-30C video data terminal is available in fully assembled form only, and is priced at $795. The EME 315 monitor costs $129 plus sales tax. Further information can be obtained from E & M Electronics Pty Ltd, 136 Marrickville Rd, Marrickville, NSW, 2204. (P.V.)

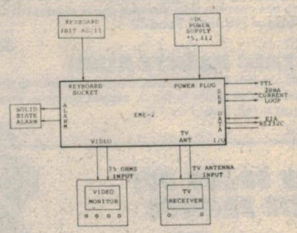
ALPHANUMERICS AND GRAPHICS REMOTE TERMINAL MODULE EME-2



GENERAL DESCRIPTION

The EME-2 video data terminal module is a dual mode single board unit designed primarily for use as a universal microcomputer remote terminal. When connected to an ASCII encoded keyboard, a video display and a dc power source, a full stand-alone video data terminal can be constructed. Communication to a computer may be either TTL, 20mA current loop or EIA RS-232-C, all of which are standard on the module. Graphic, as well as alphanumeric characters may be generated for such purposes as displaying graphs, drawing columns and underlines, displaying large alphanumeric characters, enhancing areas of text, etc.

A total of 1024 characters arranged in 16 lines each of 64 characters are displayed. The character code is contained in six bits while a seventh bit is used to determine whether the character is to be displayed as an alphanumeric or a graphic character. Simultaneous display of graphics and alphanumerics is thus possible. Each character is constructed out of a basic dot pattern of six dots horizontally by 12 dots vertically. All the alphanumeric characters are contained within 5x7 dots whilst the graphic shape may be contained over the whole 6x12 area. Each graphic pattern is made of 2x3 squares, the six squares corresponding to the six bits in the ASCII code for that character. A picture constructed out of 128 squares horizontally by 48 vertically can thus be displayed.



- 64 characters x 16 lines.
- Automatic CLEAR and HOME (on switch-on, and in response to "Form Feed").
- Home at top left corner.
- On board RF modulator.
- Auto LF/ CR after 64th entry.
- Graphics and alphanumerics simultaneously displayed.
- EIA RS 232C, Current loop & TTL standard on board.
- 75 ohms composite video out.
- Options include upper & lower case display and backspace control.

$199 Kit +TAX
$249 Ass +TAX

Video Monitor EME-315

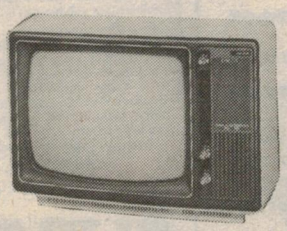
The EME-315 is a low cost general purpose monochrome 30cm video display monitor accepting a 1 volt composite video signal for use with almost all types of microcomputer systems including those requiring a display of up to **80 characters per line.** It is directly compatible with all EME series video terminal units and modules.

Power Input 240V 50Hz .35W
or
12V DC 16W

Controls

At front
On/off
Brightness
Contrast

At rear
Horizontal hold
Vertical hold
Vertical linearity
Vertical height



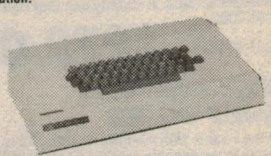
$129 + Tax

Video Data Terminal EME-20

The EME-20 is a low cost remote computer terminal for use in commercial and industrial systems as a teleprinter replacement unit. The output provides EIA RS232C, current loop and TTL for direct connection to most computer interfaces. A composite video output drives a standard monitor directly.

- **Hall Effect Solid State Keys Coupled To MOS Encoding . . . gives greater reliability with significant cost reduction.**
- **Familiar "Model 33" Array . . . ideally suited for on-line enquiries.**
- **USASCII Code Assignment . . . with four modes of operation.**
- **Two-Key Rollover . . . permits high speed operation.**

Screen Cap	1024 chars
Chars per line	64
No. of lines	16
Char comp	5x7 dot matrix
Char set	96 ASCII – 64 displayed
Refresh Rate	50Hz
Data rates	75 to 9600 baud asych
Cursor	Non-destructive flashing white block
Modes	Full and half duplex
Alarm	Audible alarm in response to BEL character
Video output	Approx 75 ohms composite video signal
Line output	RS232C, current loop and TTL
Graphics	128 hor x 48 vert picture elements available for graphics facility
Options	Upper and lower case display and backspace control



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HARDWARE & SOFTWARE From DICK SMITH

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$3,390.00 Cat. X-3260

EXIDY S-100 BUS EXPANSION UNIT

The way to go if you want extra versatility from your Sorcerer.

$575 Cat. X-3010

● Allows up to 6 plug-in cards ● Connects directly to Sorcerer's 50-way expansion socket via supplied cable ● All S-100 lines fully buffered ● Separate 2.000MHz crystal clock provided for S-100 cards which cannot use the Ø1 and Ø2 clock signals derived from the Sorcerer's 2.106MHz clock ● Provision for mounting up to six 25 pin "D" connectors for additional I/O ports, etc.

THE SORCERER

Cat. X-3001 ***SORCERER***

Cat. X-1196 ***MONITOR***

The Sorcerer is the expandable Z-80 based microcomputer that allows you to add peripherals to take it from basic computing through to advanced office business systems.

● 16K RAM expandable to 48K (on board) ● Serial I/O and Parallel I/O ● S-100 BUS compatible ● Cassette I/O for two recorders at speeds of 300 or 1200 baud ● Video I/O – 1920 characters full screen ● Full ASCII 128 characters (64 defined characters and 64 undefined characters) ● Graphic resolution 122,880 pixels ● Includes 8K BASIC plug-in ROM PAC™ in MICROSOFT™ ● Dimensions 490 x 330 x 100mm ● Weight 6 kilograms.

(Ask for our FREE comparison chart between the Sorcerer and other well known computer brands).

Dust cover to suit Cat. X-3005 ***$5.95***

$1,395.00

LIGHT PEN FOR SYSTEM 80

Cat. X-3645

$9.95

Fantastic light pen for use with your TRS-80 or System 80 computer. Uses your cassette player as a preamp. Complete with plug & battery snap. Use with program tapes below. ***ALSO FOR TRS-80***

NOUGHTS & CROSSES

Just insert this program cassette into your computer cassette player and enjoy playing the game with your light pen.

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The Micropolis mod 2 drive with controller enables you to store 315,000 bytes on just 1 disc. By adding the mod 2 add-on drive (up to 3) you can obtain up to a maximum of 1.26 Megabytes! Complete with all software to enable you to be up and running in a very short time.

Model 1043/mod 2 with controller.

Cat. X-3205 ***$1,350***

Model 1023/mod 2 add-on

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VIDEO MONITOR

This is a superb 30cm black and white video monitor that can be used on AC and DC. Simple connection to your computer. Features jitter free and distortion free characters. Can be used with most computers on the market.

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Features: ● Automatic text wrap ● Automatic checking of drastic commands ● Powerful search function ● Auto commands ● Macro programming – all this plus extensive user instructions.

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SOFTWARE FOR SYSTEM 80 *and also the TRS-80*

TIME TREK

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STIMULATING SIMULATIONS

10 games on one cassette from monster chase to nautical navigation and lost treasure. (4K level I and II).

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Create dazzling real time graphics. Commands let you draw lines, turn corners, change white to black, repeat previous steps or call other programs. (4K level I and II).

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Many variations whereby you and your opponent try and make each other collide with a wall. (4K level I and II).

Cat. X-3659 ..... **$17.95**

BRIDGE CHALLENGER

Practice and improve your game of Bridge. (16K level II).

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The computer is programmed to beat you at chess and you are trying to beat it - absorbing & educational.

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SIMUTEK 1

Contains 5 games that would normally cost $19.50 each! Great fun for all the family and friends. (4K level I and II).

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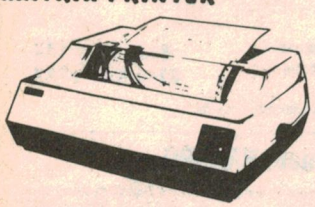
C.ITOH BRAND DOT MATRIX PRINTER



The model 8300P dot matrix printer is a no-nonsense unit that can churn out the full 96 character ASCII at a brisk 125 characters per second on standard fan-fold paper. Character spacing of 80, 40 or 132 columns which are software selectable. A quality unit that costs less than $1,000!!

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For the System 80 and TRS-80

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DS818

Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

Software & hardware compatibility: System 80 & TRS-80 keyboard differences

When a new computer is designed to be software compatible with an existing machine, does this mean that it must be, or should be, identical in all respects? There are arguments both for and against, but I believe the final answer must be "No!".

One of the interesting talking points brought up by the appearance of the new System-80 computer is the relationship between software compatibility and hardware identity. Just how close in terms of hardware configuration must a new machine come to an established design, in order to qualify as being "software compatible"? The more you think about this one, the more complex it tends to become.

In the strict sense, of course, the only way to get true and complete software compatibility is to have absolutely identical hardware. Yet if the designer of a new machine slavishly copies an established design, they deny themselves the possibility of improving upon the design by (a) using newer technology; and/or (b) building upon the experience gained from the earlier machine's period of use.

With solid state technology galloping along at its present rate, it is unusual for a newer design not to be able to take advantage of improved devices. Similarly, no design for a piece of equipment – whether it be a computer or anything else – is ever perfect; there is always room for improvement in the light of experience. So with these points in mind, it would be foolish for a designer to stick rigidly to an earlier design. Yet with every change from that design, there is always the chance that you may significantly affect software compatibility. "A designer's lot is not a happy one!"

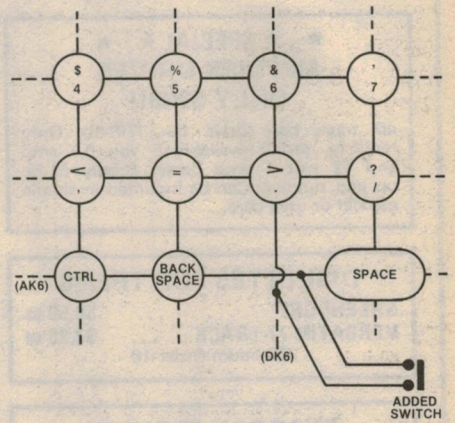
Of course designers are rarely willing to simply copy an existing design, in any case. Electronics engineers are human, and it is human nature to want to contribute something of one's own. I suppose it is inevitable that the designer of a new machine will want to "improve" upon earlier designs, no matter how successful those earlier designs may be. It is probably also inevitable that not all of the "improvements" will be worthwhile. So perhaps it is really rather pointless to talk about what should or must be done, and get down to talking about what is and has been done.

Let's consider the System-80 and the TRS-80, for example. Although the System-80 was indeed designed to be software compatible with the TRS-80, it actually differs from the earlier machine in a number of respects. All of them are relatively minor, and even when considered as a whole they don't significantly affect software compatibility. Yet they're worth knowing about.

Apart from the System-80s inbuilt cassette deck, probably the most obvious differences between the two machines are in the keyboards. Some of the differences are quite superficial: instead of the TRS-80s "up arrow" and "down arrow" keys, the System-80 has "ESC" and "CTRL" keys which perform exactly the same functions. Similarly the System-80s "BACK SPACE" key corresponds to the TRS-80s "back arrow" key, while the "NEW LINE" key on the System-80 corresponds to the "ENTER" key on the the TRS-80. Also note that although the System-80s "at sign" keytop suggests that a "backslash" character should be available in shift mode, this is not the case; as with the TRS-80, the key gives the "at sign" in both modes.

Of more significance is the fact that two of the keys on the TRS-80 are simply not present on the System-80: the "CLEAR" key and the "right arrow" key.

As the function performed by the first of these is virtually the same as that produced by the BASIC "CLS" command, its omission is no great problem. In fact it is something of an advantage, as with the TRS-80 it is all too easy to press the CLEAR key by mistake, when you intend to hit the ENTER key! The omission of the "right arrow" key is more of a problem, as some commercially available TRS-80 programs expect user input via this key.



How the missing "forward arrow" key may be added to a System-80 computer. The corresponding point in the keyboard scanning matrix is vacant, making the job an easy one.

Most of these programs can be modified to "look for" another key, without much trouble. But for those who find this inconvenient, it turns out that the missing key can actually be added to the System-80 fairly easily. Electrically, it is very straightforward: the appropriate position in the keyboard scanning matrix is vacant, so that it is simply necessary to wire in the missing keyswitch between the AK6 and DK6 scanning lines (see diagram).

The only real hassle is to add the additional switch neatly, from a mechanical point of view. The best approach seems to be to remove the present double-width keytop on the right-hand SHIFT key, and replace it with a single-width top. Then you can remove the dummy keyswitch from alongside, and replace it with a new switch – using a couple of lengths of hookup wire to connect it into the appropriate lines on the keyboard PCB. This involves a bit of fiddling, but it gives a fairly neat result. Replacement keyswitches and keytops are available from the DSE Service Department for those who wish to do it.

Well, that covers the keyboard differences between the System-80 and TRS-80. Next month we'll discuss other differences between the two.

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NEWDOS 80
IN STOCK NOW!

ND-80 ... ... $149
The disk operating system that gives:
- New basic commands that support variable record lengths up to 4095 bytes long.
- Mix or match disk drives — supports any number of tracks from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
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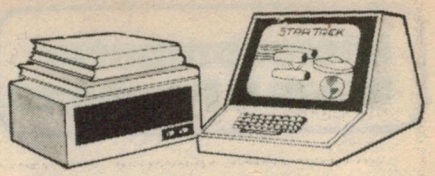

The Cognivox VIO-132 — a voice for the Sorcerer

"Hello, I am a computer. How can I help you?" the electronic voice asks. "Begin Startrek" you reply. The computer hears and obeys, and soon you are warping through the galaxy with Captain Kirk, facing hordes of malicious Klingons. At critical points in the game the same voice warns "Fuel Low", "Shields Low" "Ten Klingons approaching!". Not a fantasy of some mad computer nut, but a real possibility, at least if you have access to an Exidy Sorcerer computer.

The Cognivox VIO-132 speech recognition and voice response peripheral for the Exidy Sorcerer can add a vocabulary and a voice to your Sorcerer. Up to 32 words can be entered into the computer's memory and recalled and played back as desired. Any of the stored words can later be recognised by the computer and used to control the flow of a program. Music and sound effects as well as voices can be reproduced.

Speech signals from a microphone are filtered and the output of the filters sampled periodically, convertd into digital form and stored in the computer's memory. Playback is a matter of reading out the digital information and converting it to analog form to drive an amplifier and speaker. Word recognition is performed by comparing the digital pattern of the input word with the patterns in memory and reporting the closest match.

Cognivox sacrifices speech quality for memory storage and ease of use. Intelligibility can be quite good, however, if care is taken in entering the words into memory, although it helps if you have a deep voice.

As a speech recogniser the success rate of the Cognivox is dependent on the speaker. You must pronounce each word the same way each time it is used, and the device will only recognise the voice of the person who "trained" it — that is, the same voice as was sampled to produce the stored data. The recognition success rate of the Cognivox is said to be about 95%, but in practice, and without taking special care we found that the rate appears to be closer to 75%.

Cognivox comes fully assembled, ready to plug into the parallel I/O port of the Sorcerer. It is enclosed in a plastic utility box measuring 160mm × 96mm × 50mm, with a front panel finished in wood-grain veneer. A mesh grille covers the internal 7cm loudspeaker and at one end of the box is a volume control for playback and a microphone socket. A dynamic microphone and a cassette of operating and demonstration programs is supplied, together with an 18-page user's manual. Other applications programs can easily be written by following the detailed instructions in the manual.

We experienced no problems in getting the recogniser running. The software supplied on cassette is recorded at 300 baud to ensure reliable loading. This naturally increases the time taken to load the programs, but is not a serious disadvantage. (The manual suggests that the user re-record the programs at 1200 baud to speed loading, if desired.)

Operation of Cognivox requires firstly that the Monitor stack and Basic stack be re-located downwards to create a protected area of memory in which the Cognivox machine language driver and the speech data can be stored. A Basic program called BOOT is provided to perform this relocation.

After BOOT has been run approximate-

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ly 4K of RAM remains for user programs. The next step is to load the machine language driver, VOX2. This program is not position independent, and must be loaded into RAM at addresses 1200 to 15FF. The remainder of the memory is taken up with the look-up tables required by VOX2 and the speech data.

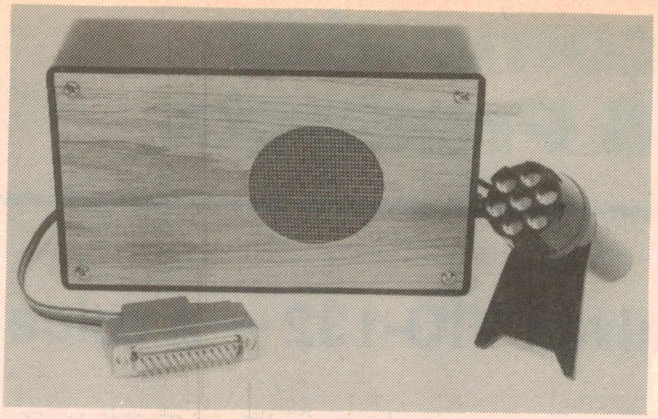
Because the stack relocation creates a protected area of memory, VOX2 and the stored speech data are not affected by subsequent loads of Basic programs. Any of the Basic application programs can be loaded into the 4K program area without the necessity to reload VOX2.

The first applications program on the cassette, PROG2, is a good demonstration of the capabilities of the system. It provides a choice of six functions, covering the entry of a vocabulary, playback and recognition. Training the Cognivox requires three passes through the vocabulary. On the first pass the device samples the characteristics of the user's voice in preparation for the second pass, which enters the spoken words into memory. The third pass plays back the stored words and asks the user to repeat each one into the microphone for a fine tuning of the system.

The words entered can be played back by using option two. I had fun getting my Sorcerer to say "Hello, I am a computer. How can I help you?", although as each word is entered separately, it requires practice to achieve an intonation which results in natural sounding speech.

Options four and five exercise the word recognition capabilities of the unit. Option four provides recognition with voice response, so that you speak the word and the computer searches its stored data for a matching pattern then speaks the word it has found. Option five is similar, except that rather than speaking the word the computer displays the number of the word (the order in which it was entered). Option six allows retraining of individual words to improve the recognition function.

The Cognivox peripheral is not restricted to reproducing words. A demonstration program called MUSIC illustrates its music and sound effects capabilities, firstly with random "computer" music then with classical and popular tunes. Several examples of similar programs are given in the manual, together with a list of values to produce specific notes of the musical scale.



The Cognivox voice input/output device for the Sorcerer. Eight programs are provided on a cassette with the unit.

All in all, the Cognivox speech peripheral is an interesting device for the experimenter, although the word recognition success rate may limit its usefulness in a practical application.

With practice and patience however, good results can be obtained in both work recognition and voice response. The interested reader can obtain further information on voice response and recognition systems from articles in the August 1976 and June 1978 issues the "Byte" magazine.

The Cognivox VIO-132 is made by Voicetek of the United States and is available from Dick Smith Electronics branches in all states. The price is $199, which seems a lot to pay for a small amount of hardware, but in comparison with similar devices available it is inexpensive, particularly as it combines both voice response and recognition in the one device. If you would like to add a voice and a vocabulary to your Sorcerer, the Cognivox is for you. (P.V.)

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AUGUST ISSUE, VOL. 11 PAGE 3.

'"DICK SMITH DRIVES" are in reality a Pertec 40 track drive they have a 20ms track to track seek and are generally quieter in their running. They have separate power supply allowing the unit to run cooler and because of their 40 tracks they store 102.4K bytes. Both sides of the diskettes can be used without modification.

"TANDY DRIVES" have been made by 2 suppliers, the earlier drives were Shugart, whereas the later models are Teac. Both these drives are 35 track units and have a track to track of 40ms. The total storage is 89.6K bytes and because of an inbuilt power supply they run quite hot and in enclosed spaces are prone to motor speed errors!! Only one side of the diskette can be utilized. Slightly noisier than the Pertec.

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Microcomputer News & Products

Computer catalogue of Australian art

Museums and art galleries have long been interested in computers, for exactly the same reason that computers are used in business – their ability to perform repetitive tasks quickly and accurately.

Consider the position of an art gallery with perhaps thousands of paintings, drawings and sculptures which must be catalogued. In Australia many such collections were formed in the 19th century but have never been fully catalogued. Even the small amount of information which has been recorded is virtually inaccessible because of the differing standards applied by various galleries to their records.

According to the Catalogue and Information Retrieval Committee of the Australian Gallery Directors Council Ltd, very few institutions at present possess a satisfactory record keeping system.

The Catalogue and Information Retrieval Committee was formed in 1975 to devise a system of cataloguing which could be used by all the public art galleries of Australia. While not formed specifically with computerisation of the records in mind, the committee was quick to see the advantages of computers in the cataloguing system. The number of works of art held by Australian galleries is so great that manual cataloguing systems, however sophisticated, would scarcely alleviate the problems of recording and retrieving the information which must be stored.

The Committee has taken the first step towards the production of an integrated catalogue of the holdings of all public galleries in Australia with the publication of the "Cataloguer's Manual of the Visual Arts". The manual provides guidelines for cataloguing art works in a standard format, and is designed for use by institutions with differing internal systems, levels of staff, and types of collections.

Each type of information which a gallery might like to record has been assigned to the appropriate data category of the system developed by the Museum Computer Network in Stony Brook, New York. The rules for each data category are set out in sufficient detail to ensure compatibility of all records and their easy retrieval within a computer system. The catalogue includes worksheets for recording information of each work of art in a common format, so that the central data-base can be operated without the need for an elaborate system of cross-indexing.

Further information can be obtained from the Australian Gallery Directors Council, PO Box R369, Royal Exchange, Sydney, 2000.

New series CBM computer

B. S. Microcomp. have announced the availability in Australia of the new 8000 Series Commodore CBM microcomputer and disk drive. The 8000 Series offers all the features of the 3000 Seris CBM machines plus an enhanced Basic interpreter and a 24 line x 80 column video display.

The new 80 column display should considerably increase the popularity of the CBM microcomputer in business environments.

The 8050 Dual Disk drive provides one megabyte of storage on two single-sided 14cm floppy disks. In addition to the disk operating system features of the Series 3000 disks the 8050 supports automatic initialisation of disks, appending to sequential files and improved error recovery routines.

For further information on these additions to the Commodore range contact B. S. Microcomp, 4th floor 561 Bourke St, Melbourne, 3000.

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*Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * and ** include firmware on 2708 and 2716. Systems marked + include 5440 media charge. Systems marked Ⓜ require the special Ⓜ versions of software in this catalog. Systems marked Ⓥ have minor variants available to suit console interface of system. Call or write for full list of options. ◇ includes hardware addition to allow our standard versions of software to run under it.*

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☐ **BASIC UTILITY DISK**—Consists of: (1) Ⓜ CRUNCH-14— Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC 4.51, BASIC-80 and TRS-80 BASIC. (2) DPFUN—Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sine, arc sine, hyperbolic sine, hyperbolic arc sine, etc. Furnished in source on diskette and documentation ..... **$50/$35**

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☐ **STRING/80** source code available separately— **$295/NA**

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☐ **WORD-STAR**—Menu driven visual word pro-Ⓛ cessing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning ..... **$445/$40**

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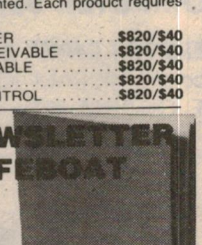

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† Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

Ⓜ Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

Ⓛ User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

① This product Includes/eXcludes the language Ⓧ manual recommended in Condiments.

Ⓢ Serial number of CP/M system must be supplied with orders.

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When ordering, please specify format code.

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Diskette, cartridge disk and cartridge tape format codes to be specified when ordering software for listed computer or disk systems. All software products have specific requirements in terms of hardware or software support, such as MPU type, memory size, support operating system or language.

Computer system	Format Code
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Apple + SoftCard 13 Sector	RG
Apple + SoftCard 16 Sector	RR
BASF System 7100	RD
Blackhawk Single Density	Q3
Blackhawk Micropolis Mod II	Q2
CDS Versatile 3B	Q1
CDS Versatile 4	Q2
COMPAL-80	Q2
Cromemco System 3	A1*
Cromemco Z2D	R6
CSSN BACKUP (tape)	T1 #
Delta	A1*
Digi-Log Microterm II	RD
Digital Microsystems	A1*
Discus	See Morrow Discus
Durango F-85	RL
Dynabyte DB8/2	R1
Dynabyte DB8/4	A1*
Exidy Sorcerer + Lifeboat CP/M	Q2
Exidy Sorcerer + Exidy CP/M	Q4
Heath H8 + H17/H27	P4
Heath H89 + Lifeboat CP/M	P4
Heath H89 + Magnolia CP/M	P7
Helios II	See Processor Technology
Horizon	See North Star
iCOM 2411 Micro Floppy	R3
iCOM 3712	A1
iCOM 3812	A1*
iCOM 4511 5440 Cartridge CP/M 1.4	D1 #
iCOM 4511 5440 Cartridge CP/M 2.2	D2 #
IMS 5000	RA
IMS 8000	A1*
IMSAI VDP-40	R4**
IMSAI VDP-42	R4**
IMSAI VDP-44	R5**
IMSAI VDP-80	A1**
Intecolor	See ISC Intecolor
Intel MDS Single Density	A1
Intertec SuperBrain DOS 0.1	R7
Intertec SuperBrain DOS 0.5-2.X	RJ
Intertec SuperBrain DOS 3.X	RK
ISC Intecolor 8063/8360/8963	A1
Kontron PSI-80	RF
Meca 5¼"	P6
Micromation (Except TRS-80 below)	A1*
Micropolis Mod I	Q1
Micropolis Mod II	Q2
MITS 3200/3202	B1
Morrow Discus	A1*
Mostek	A1
MSD 5¼"	RC
North Star Single Density	P1
North Star Double/Quad	P2
Nylac Single Density	Q3
Nylac Micropolis Mod. II	Q2
Ohio Scientific C3	A3
Onyx C8001	T2 #
Pertec PCC 2000	A1*
Processor Technology Helios II	B2
Quay 500	RQ
Quay 520	RP
RAIR Single Density	R9
RAIR Double Density	RE
Research Machines 8"	A1
Research Machines 5¼"	RH
REX	Q3
Sanco 7000 5¼"	RQ
SD Systems 8"	A1*
SD Systems 5¼"	R3
Sorcerer	See Exidy Sorcerer
Spacebyte	A1
SuperBrain	See Intertec
Tarbell	A1*
TEI 5¼"	R3
TEI 8"	A1*
Thinkertoys	See Morrow Discus
TRS-80 Model I 5¼"	R2
TRS-80 Model I + FEC Freedom	RN
TRS-80 Model I + Micromation	A4*
TRS-80 Model I + Omikron 5¼"	RM
TRS-80 Model I + Omikron 8"	A1
TRS-80 Model I + Shuffleboard 8"	A1
TRS-80 Model II	A1*
VDP-40/42/44/80	See IMSAI
Vector MZ	Q2
Versatile	See CDS Versatile
Vista V80 5¼" Single Density	P5
Vista V200 5¼" Double Density	P6
Zenith Z89 + Lifeboat CP/M	P4
Zenith Z89 + Magnolia CP/M	P7

* Single-Side Single-Density disks are supplied for use with Double-Density and Double-Side 8" soft sector-format systems.

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C4PMF (24K RAM, 32" x 64" Colour DISP., 5¼" (8OK) floppy assembler)
C8PDF (32K RAM, 32" x 64" Colour DISP., dual 8" (5OOK) floppies)

HEWLETT hp PACKARD

HP-85 (16K RAM, 16K ROM,
5" (16" x 32") DISP.
5" printer, 6O cps, RS232)

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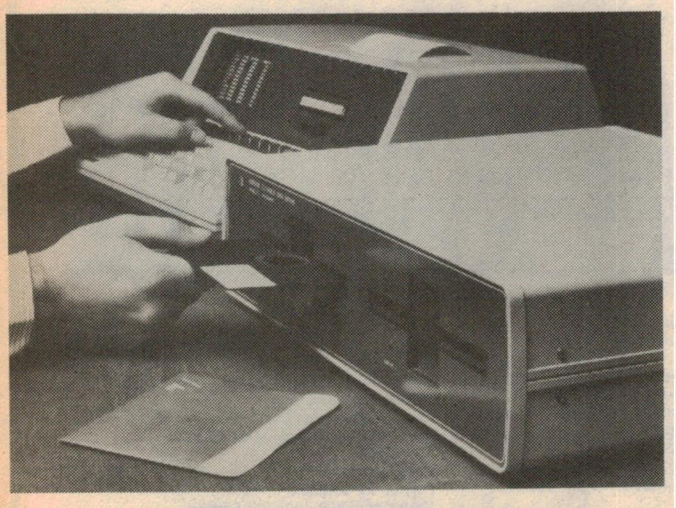
Microcomputer News & Products

Dick Smith donation to WEA

The Workers Education Association recently introduced a series of 10 week courses on Basic programming for microcomputers. In order to give participants in the courses "hands-on" experience with a typical microcomputer the WEA approached Dick Smith Electronics for assistance. DSE responded by donating a System 80 16K computer and video monitor valued at over $800 for use in the course.

Pictured above is Gary Johnston (on the right), Marketing Manager for Dick Smith Electronics, presenting Ian Burgess of the WEA with the equipment.

Dual disk drives for the HP-85



A new flexible disk drive family that provides up to 1.08 megabytes of on-line storage for the HP-85 personal computer has been introduced by Hewlett-Packard. The HP 82900 Series uses double-sided, double-density 14cm disks, and provides storage which is in addition to the HP-85's 217K in-built tape cartridge drive.

The drives can be configured in a number of ways. Shown above is the HP 82901M, a dual master drive with 540K bytes of storage. A HP 82902S dual add-on drive can double this figure. Single drives are also available, each offering 270K bytes of storage.

For more information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph St, Blackburn, Vic. 3130.

Micronews continued ►

"APC reckon they're pretty good. Just because they're giving away Sinclair ZX-80 computers doesn't mean they're anything special neither does their review of the Sinclair, the history of chess programs, the inimitable David Levy's series on artificial intelligence, concepts of computer friendliness, guidance for the novice and the rest, show that they've got the lot on microcomputers.

I know what they really need . . . an author with literary flair, panache and personality. Not to mention a sound knowledge of computers and the intricate functions of their valves and voltages."

AUSTRALIAN Personal Computer

A magazine for computer enthusiasts

Available at leading newsagencies now —

Microcomputer News & Products

Club news

● The 2650 Enthusiasts Group of Victoria still exists, although confusion has been caused by misplaced mailing lists and other records. A note from Brian L. Young, the new president, advises that the aim of the group is unchanged; to keep users in touch with what's happening with the 2650 and to exchange ideas, software and hardware designs.

Readers who have written to the group and received no reply are advised to write again to the new address, 115 Grey St, Taralgon, Vic. 3844.

● The Darth Amateur Computer Society has changed its name to TEMOS, the Tasmanian Electronics and Microcomputer Oriented Society. The object of the group is to promote information and software exchange among users of all types of computers.

Equipment presently used by members of the group includes the Apple, TRS-80, Compucolour II, Sorcerer and OSI computers. Many 2650 systems and other development systems are also used.

More information can be obtained by contacting John Stephenson, 4 Melinga Place, Taroona, Tas. 7006.

Peripherals for TRS-80

A new company, Computer Imports Pty Ltd, has been set up in Adelaide as suppliers of peripheral equipment for the TRS-80 Model I and II, including expansion interfaces and printers. Software will also be supplied through their mail order section, Micromail.

The address of the new company is Micromail, Box 7, PO Port Adelaide, SA, 5015.

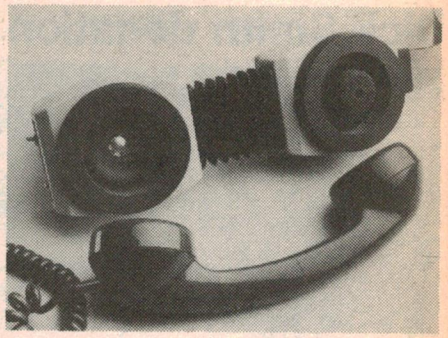
ADE's Horizon

Anderson Digital Equipment Pty Ltd has become a distributor for the North Star Horizon microcomputer. North Star systems have been available in Australia for some years now, but ADE believe that the Horizon system has lacked the support which they can offer.

The North Star Horizon is a Z80A based microcomputer providing up to 64K of RAM and two in-built quad density floppy disks with a capacity of 360K each. The motherboard has slots for 12 S-100 boards, and includes I/O circuitry, disk drive power regulation circuitry, and a real time clock. ADE plan to market the system with a Televideo 912B monitor and the Texas Instruments TI 825 printer.

North Star Basic, a Disk Operating System (DOS) and system monitor software are included on a disk with every Horizon system. In addition the Horizon supports Fortran '80, Micro-Cobol and North Star Pascal using a CP/M operating system.

Electro-med modems

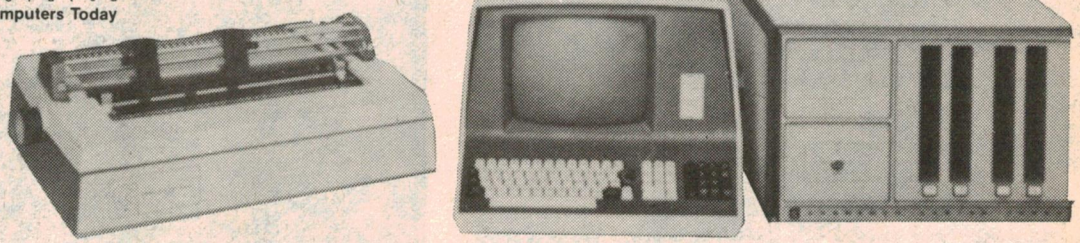


Pictured above is the new Series 700 modem, first exhibited at the 8th World Computer Exhibition. The Series 700 is based on the popular Sendata Model 1071, but its modular design enables the user to virtually tailor a modem to suit his needs.

The Series 700 acoustic modem is plug compatible with the Teletype 43, Digital LA34 and the GEC Terminet 2030 terminals. It can derive its power either from the terminal interface or from a 9V plug pack for added versatility.

For more information contact Robert Powell, Electro Medical Engineering Pty Ltd, 69 Sutherland Rd, Armadale, Vic. 3143.

Cromemco incorporated
Tomorrow's Computers Today



Here's a microcomputer with the features you want and need to do professional work in almost any field: engineering, science, business/accounting, word processing, data base management, education and countless other areas.

In the microcomputer field, the **Cromemco** system three and Z-2H Winchester hard disk systems stand alone in the range of features and capabilities offered. These systems are based on the Z-80A chip, and have from 1-4 M-bytes of diskette storage, and from 10-80 M-bytes of hard disk storage, combined with the widest range of software available in the industry, including multi-user, multi-tasking operation.

The computers have a large S100 motherboard and the operating system is a superset of CP/M, thus allowing a wide range of non-cromemco hardware and software to be used. This also provides "obsolescence insurance". Some of these features include high resolution colour graphics, EPROM programmers, remote terminal emulation, and card reader interfaces.

Cromemco basic, available in 3K, 16K, and 32K structured/KSAM versions, is fast, efficient, and ideal for teaching purposes because of its dynamic error trapping on entry, and easy file handling. Cromemco Fortran IV and Cobol are equal in power to those found on mainframes, and of course, Pascal, C, and other high level languages are also available.

Over 300 educational programs are now available, written for current curriculae in chemistry, maths, and physics.

Available software includes:
Cromemco disk operating system (CP/M compatible)
Cromemco multi-user multi-tasking DOS
3K control basic
16K extended basic
32K structured basic with KSAM
Multi-user basic
Cobol compiler
Fortran IV compiler
Ratfor compiler (rational Fortran)
Z-80 Macro assembler & trace simulator
Word processing & data base management
Payroll, receivables, payables
Pilot, Pascal, APL, C-Basic II, Smal 80.
Lisp, Algol 60, C, Microsoft programs.
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* A small number of TRS-80 programs will not run properly on the System 80 without minor modification.

- **Level II compatible BASIC as standard** (Tandy charge extra for level II)
- **Industry standard S-100 bus expansion** (They use their own non-standard system)
- **RF output: uses any TV set as a monitor** (You have to buy a true video monitor with theirs)
- **Two motor controlled cassette interfaces** (Theirs only has one)
- **Inbuilt cassette deck (no inter-connections necessary)** (Their cassette deck is completely separate)
- **Inbuilt power supply (no inter-connections)** (Tandy power supply must be connected up)
- **AND THE BEST PART OF ALL: IT IS MUCH CHEAPER THAN THE TANDY EQUIVALENT!**

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DICK SMITH SYSTEM 80

4K RAM WITH LEVEL II BASIC Cat X-4003 — **$695.00**

16K RAM WITH LEVEL II BASIC Cat X-4005 — **$750.00**

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	613 Princes Hwy,	BLAKEHURST	Ph 548-7744		842 Gympie Road,	CHERMSIDE	Ph 59 6255
	818 George Street	SYDNEY	Ph 211 3777	ACT	96 Gladstone Street,	FYSHWICK	Ph 80 4944
	531 Pittwater Road,	BROOKVALE	Ph 93 0441	SA	60 Wright Street	ADELAIDE	Ph 212 1962
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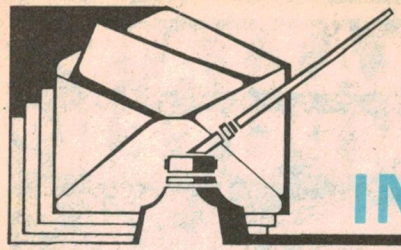

INFORMATION CENTRE

PLAYMASTER AM/FM STEREO TUNER: I have a fault in this tuner. The digital display, instead of showing 0.00 when power was applied, showed 88.8.8. It was only after quite some time that I realised that the correct numbers were being displayed for all tests but the difference in brightness between the "on" segments and the "off" segments was so small that they could only be read with difficulty. Any clues? (J. S., Mulgrave, Vic).

● It is just possible that the cause of this fault is an open circuit in one of the PCB tracks to pins 25 or 28. Pin 25 is a brightness control which we elected not to use in our design. Pin 28 is the main supply input to the chip.

If this proves not to be the fault, then unfortunately the chip is defective and must be replaced.

TIMING LIGHT: I have constructed a timing-light for which I enclose a circuit. The problem I face is to find a suitable way to pick up the ignition pulses from No. 1 cylinder. I envisage using an inductive or capacitive type pickup and have tried several methods already, none of which have been very successful. Perhaps you could suggest a pick-up arrangement to suit this circuit. (W. B. Caloundra, Qld)

● In reference to the timing-light problem we must inform you that we are not in a position to offer custom designs, but we do refer you to two articles which appeared in the magazine some years ago, both of which dealt with the same topic.

The articles we refer you to are: Timing Light/Tachometer which appeared in June, 1973 (File No. 3/TM/9) and Universal Tachometer which appeared in January 1979 (File No. 3/TM/15).

KNOTMETER: As a yachtsman sailing inland lakes I need a sensitive knotmeter for Trailer yacht racing. Those currently available are in the $200 plus bracket and employ a fragile paddle or propeller type sender which is unsatisfactory in weed infested lakes.

I need a knotmeter with a non-moving sender – AWA apparently offer one (not available in NZ) which has two screw heads underwater, set about 40mm apart, and boat speed is measured by some electronic means related to water flow between the two heads (electrodes).

As I cannot get any information on this sort of instrument in New Zealand I am writing to see if you could suggest a simple circuit which we could build to measure boat speed (0-10 knots) using two electrodes fixed to the hull.

I can only guess at the principle of the AWA unit as follows;

1. They may be using an AC waveform between the electrodes that is distorted by water flow and then measuring the apparent frequency change. A DC current method is unsuitable because of electrolysis risks.
2. They may be measuring a capacitance change between the electrodes that varies with water flow.
3. AWA may be very clever! (B. H., Rotorua, NZ)

● AWA may indeed be very clever, or it may be that their system isn't particularly simple! Certainly we can't at this time suggest a simple way of accurately determining the speed of a boat through the water using entirely electronic means, but the question has aroused our curiosity.

DREAM POWER SUPPLY: This power supply will not deliver any voltages whatsoever and besides this, the transformer becomes quite hot. I rewired it in a way that caused both 5V regulators to produce 5V at the output socket; however, the 12V line was only giving about 7V. Hoping this would work, I connected the computer to the TV and turned on the power supply. This had a marked effect on the picture but it would not produce the required white rectangle. After about one minute, the power was lost again and further attempts to regain it were fruitless.

Can you if possible work out what it is

Super Bass Filter: questions & answers

SUPER BASS FILTER: Having assembled the "Super Bass Filter" p42 February 1980, could you please clarify some anomalies I have found since I started building this for my 35W RMS player unit?

1. Why does the parts list specify a plug pack transformer?
2. Does an additional amplifier hook onto the output?
3. Does the additional amplifier have to have a Hz rating of lower than 50Hz to be of any use in the circuit.
4. Does the positive output lead work on mono to only one side of the additional amplifier?
5. Do both left and right channels of additional amplifier hook to the output of additional amplifier?
6. How do you operate volume controls if 2x amplifier?
7. Have I misplaced where 1 x .068uF capacitor goes in the parts list as only one is shown on the circuit?
8. Do the 2 x 100uF/16VW capacitors go where spaced on right of the diagram but not marked on p42.
9. Will this unit upset the feedback to transistors etc in the stereo amplifier, as to distortion etc?
10. How can the unit work and give greater bass than most speakers are built to give?
11. Will a 38cm woofer be any better than a 30cm unit? (P.D., Mosman Park, WA).

● Taking your points in order: 1. A plug pack transformer merely provides a convenient source of power. A normal 9V transformer is quite suitable or you could use the DC power supply of the amplifier itself, as described in the original article.

2, 3, 4, 5 & 6. The super bass filter mixes the left and right channel speaker output from your main amplifier and generates a mono output which should be fed to an additional mono amplifier which in turn drives a separate super bass speaker system. The additional mono amplifier should therefore have a good low frequency response down to say 10Hz and so should the super bass speaker system of course.

7. Only one 0.068uF capacitor is in fact used in the circuit. The 2 x .068uF entry in the parts list is incorrect.
8. Yes. The 100uF capacitors on the PCB diagram are those in question.
9. No.
10. See 2.
11. A 38cm woofer could possibly be an advantage over a 30cm unit but that would depend on a properly designed enclosure. Such a system was described in July 1976 in the article "80W bass system". (File No 1/SE/46)

I've done wrong or what in the circuit may have come to grief? One last thing, the transformer I am using is a DSEM-6672.

Also, can the LED display for the 2650 be adapted to the 6800? (C. R., Clayton, Vic.)

● Regarding your power supply for the Dream 6800, we are wondering how you connected up the transformer, which has 0-15-30 volt tappings, being different to the 0-15, 0-15 volt Ferguson type. You mention using the tappings F, G, H, J, but, in your case, only three of the leads should be used. The point marked J on the printed circuit board overlay diagram, should go to the 30 volt tapping of your transformer, F to the zero volt tap and G to the 15 volt tapping, equivalent a 15V-0-15V supply to the diode bridge.

It is possible that some of the components could have been damaged because of the incorrect connections. We suggest that you ensure that you have correct voltages from all three supply lines before connecting the computer.

The LED display for the 2650 can be directly adapted to the DREAM, by connecting the port inputs 0 to 7 to the optional PIA port of the DREAM, PB0 to PB7. Of course, you will need to write the software for the display.

HEAT CONTROLLER: I wish to construct the zero-voltage switching Heat Controller described in the May 1980 issue principally for use with a vertical griller with a rating of 1.8kW. The article states that the rating of the controller circuit may be extended above its 1.2kW limit by providing a larger heatsink for the Triac. Could you please advise details on how this may be carried out and also can the unit control the speed of an electric drill? (R.S., Fitzroy, SA).

● For the Heat Controller to drive a 1.8kW load, the fuse needs to have an 8A rating. A larger case would provide the extra heat dissipation as would a finned heatsink mounted on the end of the existing diecast box. We do not recommend this controller for electric drills. A speed controller for electric drills was published in the July 1976 issue.

ITALIAN TV CHANNELS: Could you please tell if it is possible to convert a Rank Arena C2603 colour television receiver, now working on Australian channels, to Italian standard channels. (L.V., Maroubra, NSW)

● The broadcast systems used in Australia and Italy are compatible, and conversion of the set from Australian to Italian channels is possible. If the set has push button tuning then it is a simple task, requiring the channel selectors to be retuned, but if it has a barrel type tuner it could be little more difficult. The fine tuning adjustment found on most barrel tuners may have sufficient range for the changeover, but if this is not so then new biscuits may have to be fitted.

TRS-80 TAPES: The TRS-80 microcomputer has more software produced for it than any other system. This software is usually transferred on a cassette readable only if you have a TRS-80. For people with computers other than the TRS-80 this vast amount of software is unusable. Would you be able to tell me the data storage format used by Tandy for their TRS-80. Also a good idea for a project would be a tape interface which utilises the TRS-80 format. (P. S., Victor Harbour, WA).

● Information on the functioning of the TRS-80 cassette interface is available in the TRS-80 Technical Reference Handbook, Catalogue number 269-2103, which is available from Tandy stores at $5.90. Data is recorded on tape in a form of Pulse Position Modulation, with a "1" represented by a 1ms pulse and a "0" represented by the absence of a pulse in a defined time interval. This time interval is set at 2ms. The use of this format, incidentally, is what makes the TRS-80 so sensitive to variations in tape speed and volume.

A tape standards converter such as you propose would be a very complex piece of equipment which inevitably would have to be tailored to the particular system it is used with. The system would have to read the TRS-80 tape and store the information contained on it, then output it to a cassette in a format suitable for loading into another computer. This however would not be the end of the matter.

RECEIVER SENSITIVITY: I would appreciate an explanation of some sensitivity figures quoted in your reviews on the Century 21 and R-1000 Kenwood communications receivers. I am not an expert in this field and I hope that you may help along these lines. For the Century 21 it is said that, based on a 10dB signal/noise ratio the figures are 0.3uV for SSB and 1uV for AM in the range 2-30MHz, 1uV for SSB and 3uV for AM over the range 0.5-2MHz. For the Kenwood R-1000 the figures are given as, 5uV and 50uV for SSB and AM respectively, from 200kHz to 2MHz and 0.5uV and 5uV for SSB and AM respectively, from 2MHz to 30MHz for a signal-plus-noise to noise ratio of 10dB minimum. The questions which I would like to ask are:

Is there any difference between 10dB signal/noise ratio and 10dB signal-plus-noise/noise ratio? I understand that the lower the sensitivity figures the more sensitive the receiver. Are the figures for the C21 much better than for the R-1000 on the lower bands? What would be the minimum acceptable sensitivity required for DX broadcast listening? (J. B., Renmark, SA.)

● The subject of receiver sensitivity is quite a broad one and manufacturers vary in their method of quoting the sensitivity of their products. When signal/noise ratio is quoted, it is safe to say that signal-plus-noise to noise ratio is implied. The next question is not so easy to answer. You will notice that the ranges covered by the two receivers are different. It is usual for the sensitivity to fall off as the frequency is taken lower and so the comparisons are not really valid. The manufacturer would quote the most conservative figure and this would normally apply to the lowest frequency. We would not venture to quote firm figures for DX broadcast listening.

Suffice to say that either of the receivers mentioned would be adequate.

240 COMMUNICATIONS RECEIVER: I am planning to build the 240 Communications Receiver as described in January to March, 1969. However, I have a few queries. Could you quote a performance comparison between the 240 and the FRG-7? I am not able to make up my mind on this issue. In the final paragraph of the description of the 240 you were reluctant to quote figures. I realise that the state of the art has advanced over the intervening years so that it may be difficult to compare the two sets. Do you consider the 240 to be worthwhile today? Could you supply me with Notes & Errata relating to the 240. Also, could you give me a source of supply for the PC board 69/F10 as used on the 240? (K. D., Frankston, Vic.).

● It would be difficult to give a precise comparison of performance between the 240 and the FRG-7 receivers, even if we had sensitivity figures for the 240, as there are other factors which must be taken into consideration. It would be fair to say that from a sensitivity point of view that there would be little to choose between them. However, the 240 design is now over 10 years old and it uses discrete components throughout. Also, it would be wise to check the cost of a kit for the 240, keeping in mind that some components may be difficult to obtain.

We imagine that the main reason for one wishing to build a receiver like the 240 would be for the experience and the satisfaction of having built it yourself. Notes & Errata for the 240 appeared in February and April, 1970 and we can supply copies if required. We understand that Radio Despatch Service, 869 George Street, Sydney 2000 can still supply the 69/F10 PC boards.

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Specs. 240VAC 50Hz, auto or manual operation ● Plays 17, 25. 30cm (7, 10, 12in) records ● 33 and 45 rpm, adjustable counter weight and stylus pressure ● cueing lever ● Bias compensator and anti skate control ● Big platter with mat ● RCA audio plugs and cable, 3-core power cable and plug ● High quality ADC magnetic cartridge ● Diamond Stylus ● Cut-out Template, instruction book ●

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TOP BRAND. GOOD QUALITY GUARANTEED. FULL 90 DAYS PARTS AND LABOUR WARRANTY.

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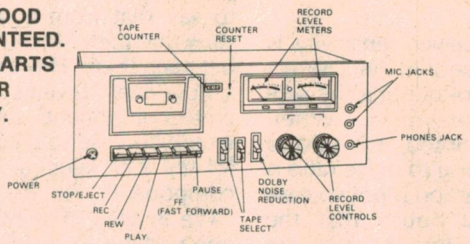

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FOR LOWER DISTORTION, BETTER BASS.

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4W MK6	10.5	15	65	65-14000	$14.95	2.00
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High performance ● connector ● zinc diecast body ● protected mesh metal ball ● mic holder ● 73dB at 1KHz. 6M. Twin cable. carry case ●

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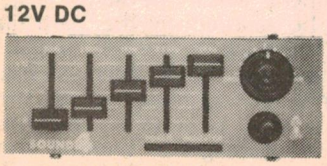
ULTRA MINIATURE 5 BAND GRAPHIC EQUALIZER AMPLIFIER ●



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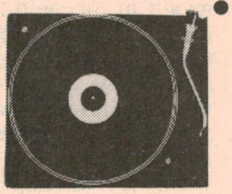

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Model P-207 ● 240V AC. 50Hz ● Auto-Stop ● S-Shape tone arm ● Ceramic cartridge, diamond stylus ● 33-45rpm ● Plays 17, 25, 30cm (7, 10, 12in) records ● Cue lever ● Template for cut-out ● operating instructions

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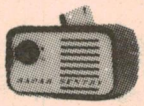
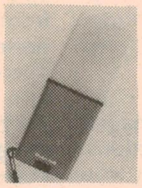
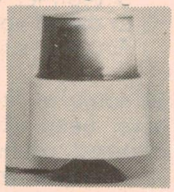


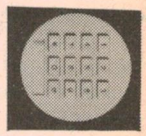
X-Band Radar Detector **$14.95**



Honeywell Handheld Electronic Strobe Light Flasher. **$9.95**



Red Rotating Distress Beacon. For car, boat, Disco. 12VDC. 2A. **$6.95.**



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Radar Detector	Ref	June	Advt	1980
Honeywell	Ref	Dec	Advt	1979
Red Rotating	Ref	Dec	Advt	1979
Push Button	Ref	Dec	Advt	1979

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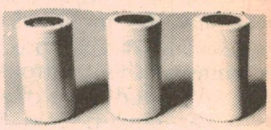

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Many programs written for the TRS-80 cannot be run on another computer, even if they could be loaded. For example, the graphics capabilities of the TRS-80 depend on the particular screen and memory configuration of that computer. Other computers just would not accept the command "SET (x,y)" as used by the TRS-80. Each program for the TRS-80 would need to be rewritten before it could be run on another computer, even if the cassette format problem could be solved.

ELECTRONIC IGNITION SYSTEMS: I have been advised to write to you regarding electronic ignition systems. I have some information on the "Firefly" ignition system (enclosed) but would appreciate any information you may be able to offer regarding other comparable systems that be a little cheaper. If so would the quality match that of the "Firefly"? Any information you could let me have would be appreciated.

Dick Smith Electronics has a unit for $25 but I would like to know if the "Firefly" system is superior. (S. W., Woonona, NSW).

● We are not in a position to offer you any advice as to which unit is superior, cheaper or otherwise to the "Firefly" model you mention. It is not the practice of this magazine to provide this type of information on commercial products.

LASER PROBLEMS: I recently built the laser project featured in the October issue of EA, and when I first turned the unit on, everything appeared to be working properly but after about two minutes I could smell something burning. After turning it off I discovered that the insulation around the ballast resistors had melted. In the assembly notes provided by Laser Electronics (the tube suppliers) they mention that it would be desirable to insulate the ballast resistors in a glass tube, but that this was not mandatory to this operation.

Since I could not get any glass tubing I used the conventional plastic spaghetti. If the ballast resistors get so hot as to melt the plastic, what would happen after half an hour or so? Would the resistors burn out? I was also told by Laser Electronics that the beam could be seen when it strikes dust particles in the air, but the beam appears to be completely invisible. Either I have a very clean house, or something else is wrong. Could you please advise? (B. R., Matraville, NSW).

● The problem that you mention with regard to the ballast resistors in the laser unit is not a serious one. The ballast resistors do in fact get quite hot, to the point where they will melt plastic but this is normal. The reason glass insulation was recommended was to further remove the possibility of someone touching any of the wiring around these resistors.

If you remove the plastic spaghetti insulation from around the resistors and space them some 10mm apart you will find that the laser will operate as it should. We suggest that the unit not be operated while the cover is off as the high voltages can be extremely dangerous.

Your other query regarding the visibility of the laser beam has nothing to do with the ballast resistors. The beam itself is usually invisible but it can be seen as a small red dot when it strikes a white surface. To see the beam as it passes through the air you would need quite a high level of airborne dust.

PLAYMASTER 143 STEREO AMPLIFIER: I started building the Playmaster 143 amplifier over a year ago, and since then have had trouble with the power amplifiers. To start with, I cannot get the quiescent current level down below 100mA. I have checked that the transistors are all in their respective places, and checked all the other components but still to no avail. The second problem is low frequency hum. I have checked the power supply rails but there does not appear to be anything wrong there.

The amplifier has been built on a wooden base with a control panel of sorts along one edge. Could the layout be responsible for the problems? (R.S. Wembley Downs, WA).

● Well R.S., the layout that you describe could certainly contribute to the noise and hum problem due to the lack of adequate shielding. This may also cause instability in the power amp modules. You can check this by shorting the emitter and collector of T5, resulting in the removal of bias for the two output transistors. The quiescent current measured at the link point should now drop to zero. If this does not happen then the output stage is probably unstable, ie, oscillating at a supersonic frequency.

The power amp module as described can be unstable unless it is connected exactly as we described in the article, and the same applies to the rest of the circuitry. We suggest that you build the whole unit exactly as we described it.

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

NOTES & ERRATA

LEDS & LADDERS GAME (August, 1980; File No 3/EG/18): the parts list should read 2 x 68k resistors, not 1 x 68k. Also, the 150k resistor listed should be omitted.

TRACE ROUTINE FOR 2650 SYSTEMS (February, 1980; 8/M/45): several readers have written to us regarding an error in the program listing. Mr R.D. Avery, North Adelaide 5006, has provided one solution, as shown below.

```
0C98 0D0401  :        LODA,R1  COM+1
0C9B 0E0402  :        LODA,R2  COM+2
0C9E 0F0403  :        LODA,R3  COM+3
0CA1 7710    :        PPSL     RS
0CA3 0D0404  :        LODA,R1  COM+4
0CA6 0E0405  :        LODA,R2  COM+5
0CA9 0F0406  :        LODA,R3  COM+6
0CAC 0C0407  :        LODA,R0  COM+7
0CAF 92      :        LPSU
0CB0 0C0408  :        LODA,R0  COM+8
0CB3 C806    :        STRR,R0  PLL
0CB5 0C0400  :        LODA,R0  COM
0CB8 75FF    :        CPSL     -1
0CBA         :        DATA     H'77'
0CBB         :PLL     RES      1
0CBC 17      :        RETC,UN
0CBD         :*
```

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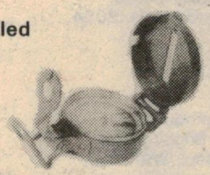

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4" Magnifier suspends from neck and rests on chest, leaves hands free ideal for mum or gran, sewing, etc.
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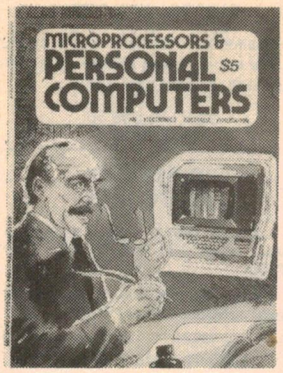

Just Off The Presses

MICROPROCESSORS & PERSONAL COMPUTERS

Order your copy now!

Microprocessors and personal computers, little more than a dream a few years ago, are now changing the face of electronics. This book introduces the basic concepts, describes a selection of microprocessor and personal computer systems, and details a build-it-yourself computer designed especially for beginners.

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ELECTRONICS AUSTRALIA

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Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

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Rod Irving Electronics,
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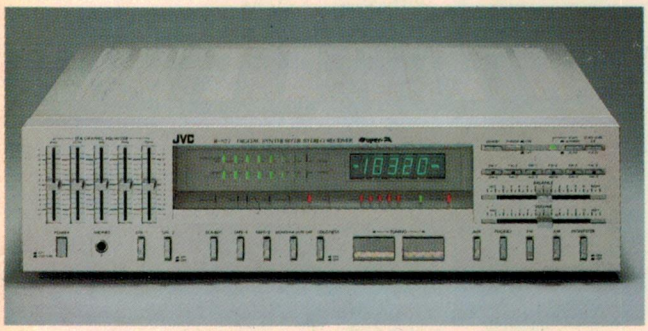
UNTIL WE DEVELOPED THE STEREO GROOVE, HI-FI WAS PRETTY HO-HUM!

The world of hi-fi owes a lot to the original and continuing innovation of JVC. Few companies, if any, have done as much to help turn records and record-players into the virtual musical instruments they are today . . . or to lead the way in developing so many *firsts* in the more recent concepts of sound amplifiers, cassette decks and computer-designed speaker systems. Hi-fi, as we know it today, had its beginnings in 1956, with JVC's development of the 45°/45° groove for stereo records. The fact that this system still remains as the world standard is, in itself, outstanding testimony to the technology of JVC. The development revolutionised not only the record-*making* industry, in which we've been involved since 1930; it also paved the way for enormous advancement in the design and engineering of record-playing equipment. Now, hi-fi has expanded to



R-S77. Super-A FM/AM Stereo receiver

embrace a wealth of highly-sophisticated electronic equipment; and it's not surprising that JVC has continued to play a leading role in so much of its development.

HR-3660 EA. VHS Colour Video Cassette recorder

THAT WASN'T OUR ONLY FIRST, EITHER.

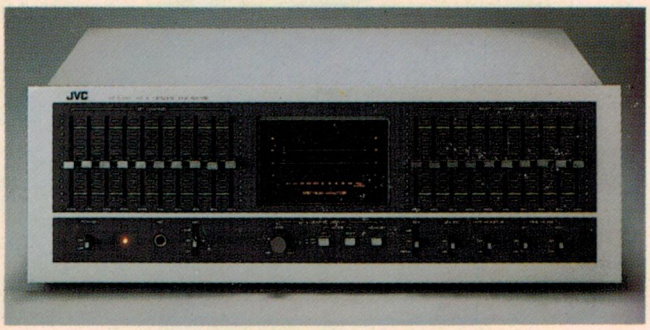
We also pioneered Japan's television industry, introducing their first TV receiver just over 40 years ago. A more recent innovation is VHS, the home video recording system now gaining world-wide acceptance as *the* system for such equipment. In the course of staying ahead, we've introduced a number of world *firsts* of radical importance: the Quartz Lock turntable is one of them.

THE QUARTZ LOCK TURNTABLE. MANY TIMES MORE ACCURATE.

It stands to reason that if your equipment is at the top end of the range, then your turntable must be capable of comparable performance. Only Quartz Lock ensures this, tying the speed of the turntable to the unvarying pulse of the atom, and providing a level of accuracy far in excess of conventional turntables.

MORE MILESTONES IN HI-FI.

To match the superb quality of Quartz Lock, we produced the S.E.A. graphic equalizer system. Then we refined it to such a degree it even compensates for the effect your furniture has on sound when it leaves the speakers! To expand the capabilities of tape, we designed ANRS and



SEA-80. Stereo Graphic Equalizer

Super ANRS — automatic noise reduction systems which not only reduce distortion and 'hiss' but actually extend the dynamic range of the tape. Similarly, with speakers: at JVC we employ computers in their design to help provide the ultimate in sound reproduction.

AND NOW, SUPER-A.

In its own way, as significant a hi-fi development as the stereo groove. Imagine an amplifier which combines the *best* features of the two recognised amplifier classes (A and B) . . . an amp which combines the *efficiency* of one with the *low distortion* of the other. Some engineers said it couldn't be done; but not those at JVC. Enter the Super-A amplifier . . . the *latest* JVC *first!*

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HAGEMEYER

JVC
the right choice

THE FUTURE.

It's already with us. For instance, we were so far ahead in the new metal tape technology that our cassette decks were metal-compatible before the tapes were generally available. And now there's the JVC Electro-Dynamic Servo Tonearm, damping tonearm resonance by means of a purely electronic system and two 'thinking' linear motors. Who was it who dubbed JVC, 'the innovators'?

1861

Technics SL-10

Quartz-Phase-Locked Control Direct-Drive Turntable with Linear Tracking Tonearm

Sounds Alive

Marking the 10th anniversary of the direct-drive turntable.

It has been 10 years since Technics introduced the world's first direct-drive turntable, the SP-10. When it was introduced this turntable had less wow and flutter and better speed accuracy than the cutting lathes used to make records. And because the drive system did not use rubber parts like belts and idler wheels, it insured that its excellent specifications would be retained for a long time.

Six years after the introduction of the SP-10, Technics brought out an improved version, with higher torque and quartz control. Today, more than 1500 of these SP-10MKII's are used by broadcasters in 27 countries around the world.

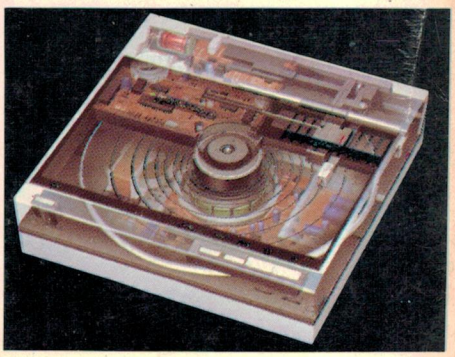
In the past two years, Technics has added quartz synthesizer control to various models, permitting the precision of quartz to be retained in speeds above and below the standard 33-1/3, 45 and 78 rpm.

More significant to the consumer, Technics has also developed direct-drive turntables which have a very high degree of precision, yet cost much less than the professional grade models. It is possible to get numerous Technics direct-drive turntables in the popular price range, yet with specifications that were obtainable only in very expensive equipment a few years ago.

With the SL-10, Technics continues to lead the industry in turntable innovation. This new turntable represents as radical a departure from conventional design as did the SP-10 ten years ago.

It has the same width and depth dimensions as an LP record jacket, yet within the compact package are an amazingly precise drive system, a gimbal suspended linear-tracking tonearm, a high-grade moving coil cartridge, plus extensive control systems which permit even a complete hi-fi novice to use the SL-10 without any problem. Nearly every operation is automated, with the upper and lower halves of the cabinet closed during record play. And the tonearm is designed so that the system can be stood vertically without any sacrifice in tracking accuracy. The SL-10 marks as great a step forward in convenience as did the development of cassette tapes versus the open-reel format. Yet there is absolutely no loss in reproduction quality. On the contrary, numerous factors in the SL-10's design will significantly enhance the sound from records.

Technics changes the face of turntable technology . . . again.



Technics

For further information contact The Technics Advisory Service,
P.O. Box 319, North Ryde 2113

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